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### Lancashire Section

#### FUTURE MARKETING OF RAW COTTON.

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*(Paper delivered to the Lancashire Section, 8th October, 1943)*

Under present conditions, it seems bold to attempt to discuss this subject. During the war, and for some period after the cessation of hostilities, we must work under government control. But it is right and necessary to consider how control can be gradually relaxed and ultimately abolished, and with what machinery it should be replaced.

In cotton we are entirely dependent for our raw material on foreign countries: as we must also be for outlets for the main bulk of our manufactured production, by export. Therefore any plans we may consider must depend on available exchange and freight and on any international control either of finance or of commodities. In these matters we are completely in the dark. England and U.S.A. are trying to evolve schemes to stabilise international exchange rates and to create credit to enable international trade to function once more. When we realise the desolation throughout Europe, Russia, China, and the Far East this is no light task. Also England and America must work in collaboration with the United Nations and cannot dictate terms without a breach of their declared war policy.

The tremendous demand for replacement of raw materials, food, clothing, and all necessities, caused by Germany's systematic loot and robbery and destruction in every European country, makes it obvious that for some period there must be international control and rationing of the available supplies. We must hope also that in some way maximum prices may be fixed internationally for basic raw materials until production naturally increases, and so avoid the wild uprush of prices experienced after the last war followed by paralysing reaction. As regards the spinning trade, minimum margins, to be approved under the Enabling Act, were promptly adopted by the Control as fixed margins, being adjusted from time to time partly to meet increased cost of production. If, when the Enabling Act comes into force after the war, as at present enacted, maximum margins, as well as minimum margins, were to be approved by the Board of Trade, exploitation of the situation would here be completely controlled. It is essential both on moral and economic grounds that this should be so.

All these problems are being faced and considered and, perhaps by trial and error, a way out must be found. But we must face continued control for a limited period.

It is quite practicable to control our industry, while leaving the actual administration, under the control, to the Associations practised and experienced in the working of the business. In wheat, the provision and other trades, this has largely been done. The Liverpool and Manchester Cotton Associations were

called in by the first Cotton Controller, to be replaced later by the Cotton Importers and Distributors Co., formed at the instance of the Government for this very purpose. Immediately after the formation of this company in April, 1941, it was faced by the severe blitzes in Liverpool, and later in Manchester, which disorganised at times dock and transport facilities, and, as very late shipments of cotton arrived unexpectedly at the same time, the difficulties were very great. Instead of cotton being stored in the recognised warehouses in the two ports, it had to be forwarded without delay to scattered, and often unsatisfactory, storage points up country, where it was handled generally by inexperienced men. No delay could be permitted on the dock quays, with the result that there was frequently almost unavoidable congestion. As a member of the Board and Executive, I can assure you that we were getting everything into smooth running order when the new controller (Sir Frank Platt) decided that he must have the whole administration under his own control, and demanded the liquidation of the Company. At present the Controller's own organisation, profiting by the experience and using much of the machinery created by Cotton Importers and Distributors' Co., administers the whole business.

In my opinion the first step in decontrol should be to restore the administration, that is the buying and distribution, to the two Cotton Associations, which, when the time arrives, could also liquidate Government unsold stocks and any forward purchases for shipment. All operations would be under the authority and general direction of the Control, but the buying would be done more efficiently by those who have spent their lives at the job, and who have the widest experience. Also the handling and distribution would be done with less expense, and with greater elasticity for spinners. But the main purpose would be to enable the importing firms, whose services have been practically dispensed with, to get into stride once more, ready to take over as soon as control could be dispensed with. When that happy time arrives, the first essential is to re-establish the Liverpool Futures contracts.

The main purpose of these contracts is to enable growers, shippers, merchants, spinners and manufacturers to hedge their commitments and so avoid the risks of fluctuation in prices. So far as importers are concerned, because in the past they could eliminate fluctuation in prices from their calculations, being insured against them by their hedges, they were able to handle large quantities of all growths of cotton at a very small margin of profit. For the same reason Banks would give advances of 90 per cent. on hedged cotton and so, when opportunity offered, merchants could purchase unlimited quantities of cheap cotton from whichever country it was offered. As a result, a stock of 1,000,000 bales was generally available in this country from which spinners could select whatever quality they required, for immediate delivery, or for delivery at any date they might require it. For the greater part of each year cotton could be bought in Liverpool at less, sometimes considerably less, than replacement cost in the country of origin. These facilities were the envy of every cotton spinning centre in the world, including mills in the neighbourhood of cotton fields. These facilities must once more be available to the spinner of Lancashire, for whom, once the immediate post-war demand is satisfied every possible advantage will be required if we are to compete for export trade.

The existence of futures markets makes cotton a cash crop, wherever it is grown. Quotations are cabled to every up-country cotton market in the world and growers know the daily values of their crops. Merchants compete in these markets for the qualities they require for their customers, thus ensuring the growers a fair market and the same full competition exists between merchants when they try to sell their stocks to spinners. Without Futures markets these great facilities to producers and consumers would be impossible. It is the universal custom to buy cotton at its value relative to futures quotations and immediately a purchase is made it is hedged by a sale of futures of equivalent weight. When the cotton is sold it is again based on the ruling quotation of futures and the hedge sale is bought back. Thus the Futures

markets are used to insure against fluctuations in price. Being able in this way to eliminate fluctuations in price from their calculations, and being subject to the most severe competition, merchants trade at a very narrow margin of profit. A gross profit of 1 per cent. on the turnover is their average gain on the trade. For this margin they pay cash abroad for their cotton, transport it and store it, select it into even running lots for both grade and staple, and give every facility to spinners as to delivery. They are prepared to cover spinners requirements of exact qualities for many months ahead, and allow spinners to fix their price on the ruling quotation of futures, when they sell their yarn, or at any time.

No other trade has such facilities. In no other trade is the importers margin of profit so small. The value of these facilities to Lancashire has been, and is, incalculable.

It is therefore absolutely essential that at the earliest possible moment futures contracts should be re-established here. They will certainly be re-established in America, in India, and Egypt, and unless we have a world market for futures in Liverpool, spinners will be at the mercy of foreign markets. As Liverpool and Manchester merchants, with a futures market, are prepared to buy any amount of cotton from any country, provided its value relative to the futures contract is reasonably cheap, Lancashire taps the whole world for her cotton, and so is independent and can buy as cheaply as any of her competitors, and much more cheaply than most, who are dependent on overseas quotations.

Liverpool is the only spot market in the world, where large stocks are carried of all growths of cotton, and where, as a result, the relative values are adjusted. It is the only true world cotton futures market, as distinguished from New York, Bombay, and Alexandria, dealing only in their own production: and being largely independent of immediate circumstances in any one country it is able to stabilise values. But all this is absolutely dependent on the facilities of an active futures market. Such a market must be broad and reflect the conditions and opinions of all producers and consumers throughout the world. It must be kept in correct relation with overseas values by arbitrage operations.

It would be impracticable to open such a completely free market until conditions have become more stabilised. But contracts, based perhaps on the limited contract functioning for six months before the futures market had to be closed, owing to the Government deciding to import all cotton on its own account, could be produced by the Board of the Liverpool Cotton Association, until such time as a free market could be established. Such a contract would be framed to protect both buyers and sellers from the risks of price fluctuations. As and when conditions allowed it could be broadened.

To summarise, my suggestion therefore is, that soon after the termination of hostilities, the Controller should work through the Liverpool and Manchester Cotton Associations, using them to carry out his policy and liquidate his commitments. As soon as practicable the Liverpool Futures Market should re-open, at first under limitations necessitated by unsettled conditions, and gradually be re-established to serve the interests of the whole trade, as in the past, by providing insurance against the risks of loss due to fluctuations in price, and thus be able to provide Lancashire with ample supplies of the cheapest cotton in the world. To re-establish a great export market these conditions are essential.

I have been expressing my opinion perhaps dogmatically, in my desire to make it clear. I know I am also reflecting the opinion of the Liverpool and Manchester Cotton Associations. But perhaps you will allow me to quote other opinions in support of my argument.

The International Chamber of Commerce representing 32 countries, and also bankers interested in financing commodities, held a conference on "Futures Markets, their functions and uses". I will read, if I may, their findings:—

"The Congress recognizes the fundamental services performed by futures

markets in the organized distribution of certain agricultural and industrial products, namely: in correlating the world demand and supply; in making a world price and keeping it uniform; in providing machinery for continuous trading by enabling a suitable price to be quoted for the commodity at any time; in minimizing and smoothing out price fluctuations; in discounting the impact on the market of forecasted supply and demand and in spreading over a long period the burden of distribution of a short-period agricultural harvest; in providing security which justifies the grant of liberal credit facilities by bankers; in making available at all stages of production, distribution and manufacture, a valuable safeguard in the shape of insurance against fluctuations.

"The Congress considers that the Report prepared by the Committee on Trading in Futures justifies the function of futures markets. The function of the speculator is to carry the risks of price fluctuation which are encountered at every stage in the production, manufacture and distribution of a product. The chief service rendered by trading in futures to industry and trade is undoubtedly this facility for the transfer of risks. When dealings in the market are restricted or prohibited, a futures market is prevented from performing its true function. The broader the market the more efficient are the services rendered by it."

I would like also to quote from a recent speech of the President of the London Metal Exchange, which deals in futures, so that again support may be given to my arguments:—

"Without hedging facilities the ore producer would, in effect, have to gamble on the outlook, as also would the smelter. Similarly the manufacturer would be an unwilling speculator if, on booking a contract for his finished article, he were unable to guard against price fluctuations of his raw materials. Without such facilities some other form of insurance would be necessary.

"Yet, it would appear that there are some who would be willing, nay anxious, permanently to dispense with the open market after the war, and to substitute for it a new system in which prices would be fixed and supplies guaranteed by the Government. It may be doubted whether what is expedient during a national emergency is desirable or even practicable in more normal times. For, failing complete international agreement, amounting almost to the institution of a world state, no single Government could guarantee supplies at a fixed price for an indefinite period.

"Let it not be forgotten that under a system of Government trading each foreign purchase and sale acquires a political significance, which is wholly absent when the business is transacted in a free and open market.

"The considerable fluctuations which take place in the open market at times are the reflections of events usually unconnected with the market itself, and are but symptoms of conditions in the economic world as a whole. The actual market is merely one place in which the views and policies of the world react on each other.

"These fundamental causes, of whatever origin, be they natural, political, economic or financial have, under the free market system, a gradual effect on prices. Under any system of control the necessary alterations in prices are delayed until adjustments become inevitable, and consequently the results are more severely felt.

"It is so often forgotten that while in certain cases speculators appear to intrude into the market and bring into it an element which should not be there, yet in reality they are often only shifting to their own shoulders risks which, in any case, have to be borne by someone, whether it be Government, producer, merchant, consumer, or the public."

If it will not weary you, I think quotations from the speech of Mr. Lennox Lee, at the annual meeting of Calico Printers Association, on the question of control and the reversion to individual enterprise may interest you:—

"A few weeks ago the Home Secretary said that we were not fighting to overthrow Fascism in order that it could come in at the back door under some other name. What, after all, is Fascism but bureaucratic control and the sub-

jection of every individual and enterprise to the needs of the State as determined by those in authority, and what is the present regulation of our industries but bureaucracy in its most virulent form?

"For their own sakes and for the sake of the country the export industries must be freed from control and restrictions and from anything tending towards monopoly, particularly State monopoly.

"An export trade of the size essential to the national economy would be most difficult to achieve under State control and impossible in fashion trades such as textiles.

"Private enterprise is still prepared to take the risks which are its historic function and to reorganise itself for efficient and economic production if given anything like a reasonable opportunity, but with regard to industries engaged in foreign trade, a complete system of State regulation of industrial conditions in the interests of social policy is impossible if the same conditions are not to be imposed on overseas producers."

I have not anticipated the criticisms which will arise in the discussion which is to follow this paper. The discussion will be of greater value, I think, than my efforts, and they will take up the greater part of our time.

In spite of my criticisms as regard the import and distribution of raw cotton under the Control, because I consider more use should have been made of the services of those with lifelong experience, I would like to say that as a war-time measure, when cost is of secondary importance and is borne by the taxpayer, and when in many sections of the Trade standard qualities have had to go by the board, of necessity, the control of this vast and complicated industry has been well administered. Over centralisation must make it more difficult to re-establish and to get back to the individual effort which has inspired and built up this vast industry.

#### DISCUSSION

*Col. W. A. Grierson:* I agree with Mr. Muir that the question of marketing raw cotton is of vital importance to the Lancashire industry. I think we can all agree that we are not returning to the 1939 conditions of world trade. If we are returning to those unregulated conditions of the 1930's, which were disastrous to the world, if we are to return to unregulated fluctuating prices, then we have in the Liverpool and Manchester Cotton Associations the best type of organisation. But are we satisfied with those unregulated conditions? At present all signs are pointing back to the old conditions, and if we do return, and after the period of re-stocking the world cupboards, there is every indication of another world clash.

Formerly, the main difficulty was the disequilibrium between highly organised industry and disorganised agriculture. At one time the farmer had to pay the yield from two years' crops in order to buy one year's goods. The boom and slump were accepted almost as natural phenomena. I can only say that if that is to be the future of trade then it spells disaster for Lancashire industry.

One half of the world's population is living on an amount equivalent to £5 a year. If this can be raised to a reasonable standard of living then there will be created an enormous consumption demand. Are we going to try to organise a thousand million people in order to meet the demand, or can it be done by the business men and farmers themselves in day to day transactions? A lead was given by the wheat agreement initiated in Washington three years ago. Then the four major producers and one major consumer of wheat agreed on maximum and minimum buffer stocks and on export for world trade. They arranged a price for wheat growers that was reasonably remunerative and in reasonable relationship to the price of other foods.

The Hot Springs Conference dealing with all foods agreed that in addition to a satisfactory price for the agricultural community it was necessary that supplies and prices should also be to the satisfaction of the consumer. Everyone should support the Hot Springs Conference on food and in addition another conference should be called to deal with all raw materials.

The farmers require a steady price for cotton so that when they sow the seed they will know what income to expect from the harvest. We should fight for the method of regularity and stability of prices. It is said that if there is to be a world price for cotton there will be no function for the Liverpool Cotton

Association, but it will still be necessary to buy cotton and we don't want the Government to do the buying. We should require the Association to buy the stocks then if the present commission is not satisfactory we should come to some agreement with them in order to satisfy all parties.

*A. Bryce Muir:* I think there is such a thing as the Atlantic Charter bringing people together and allowing these people to buy each others goods.

*F. E. Mason:* Mr. Muir has made one point that requires a little further expansion. Was it correct that for all the services rendered by the futures market, a charge of only 1 per cent. was made. If that is so I would like to know if anybody can think of any other industry where the same functions are exercised for 1 per cent.?

*A. Bryce Muir:* An advantage of 1 per cent. is all the merchants have been able to secure for services rendered. They only attempt to make 1 per cent. as an average. No other trade could attempt it without futures.

*W. W. Higgin:* With reference to what Colonel Grierson has said, though he envisages the possibility of merchant trading in some sort of capacity, he is really advocating State trading. Yet, what we have to consider is either reversion to the real services rendered by a merchant or the Government taking them over.

The basic difficulty which we have to solve is the question of getting buyers for what were in the past and may be in the future the surplus products of the world in order that farmers throughout the world may get a reasonable standard of living. Therefore, the fundamental point is how are we going to provide these people who have no purchasing power with the wherewithal to buy.

I suggest that a common measure of agreement on certain aspects of monetary policy has been reached in the monetary plans recently put forward. Monetary policy is at the base of the whole matter. In the years to which Colonel Grierson was referring the policy was one of restriction. When the banks started to withdraw capital from trade a slump started and I believe the solution of the problem is the solving of this matter of credit.

Doubtless we are all aiming at the same goal but it is to my mind a serious matter that the problem is being tackled on the basis of assumptions which I believe have no foundation. The solution put forward is in effect a disguised form of subsidy by the Government to be substituted for free market conditions; in other words, the taxpayers are expected to find the difference.

International agreements will last only so long as all the signatories thereto agree to be bound by them.

In connection with the Wheat Agreement which has been recently initialled but for which no date has been fixed for its coming into operation, I would like to draw your attention to a document issued by the Stansfield University in California in concluding their analysis of it:—"For a peace-time world, this elaborate system of restrictive regimentation seems out of harmony with evolving principles of international economic relations appropriate to a world rededicated to freedom and progress."

We should be faced with disaster if the Government usurped the functions of the private trader. We shall have to stand again on our own feet and in order to get our trade back we shall need the benefits conferred by the competition provided by private enterprise.

*D. D. Livesey:* Col. Grierson has made several dogmatic statements that can easily be refuted. I hope that he will give us a more reasonable opportunity to debate these. My information from America absolutely contradicts his claim that opinion in the U.S.A. is in favour of stabilisation and control of distribution. His statement that the grower of cotton does not need or use the Futures markets is equally incorrect. He is advocating the same post-war planning suggested by Mr. Dalton during his visit to Manchester—their policy of State Control and Dictation belongs to the "isms" that have disrupted the world, the very systems that we are fighting to destroy. We must make our choice between the revival of our pre-war machinery, with modifications that may be necessary, and the policy of State trading. Stabilisation of world prices is an idle dream, certainly Lancashire could not hope to compete internationally on such a basis. Is it reasonable to expect that, say, Brazil would forfeit her commercial advantage when she was favoured with a much cheaper crop than America? Countries will not act contrary to their economic and domestic interests.

*Mr. Jacks:* What we stabilise is but a symbol, not the price and what it will buy.

I think that if we open the markets of the world, we shall have the demand for raw materials, etc., and it will be so great that the farmer will get his price which will enable him to buy the other things which he needs.

*A. Bryce Muir:* I entirely agree with the last speaker and believe that the solution lies there. We must free the channels of trade and then I think matters will mend themselves.

## Midlands Section

### TEXTILE FIBRES AND RUBBER AS ASSOCIATED MATERIALS FOR MANUFACTURE

By C. M. BLOW, Ph.D., F.I.C., and W. KNIGHT, A.I.R.I.

(Paper delivered to the Midlands Section, 27th November, 1943).

#### INTRODUCTION

The title of this paper suggests a more comprehensive field than in fact it is proposed to cover. No attempt will be made to catalogue all the products in which rubber and textile fibres are used together, but rather to deal with the broad principles indicating the requirements of the rubber and the textile material for the various types of products, and discuss recent important developments.

It so happens that the subject matter divides itself into two fairly clear-cut sections. The first part will deal with the products which are essentially rubber products, but which contain a textile material that plays a fundamental part in their performance and use. Such products as tyres, belting and hose, and the problems and developments connected with their manufacture form the subject of this part.

The other section covers what may be termed the converse—i.e. the essentially textile products which contain rubber to impart some property or effect. Such items as rubber thread, the latex backing of carpets and other pile fabrics, proofed fabrics, etc., occur to one. These are of interest but of recent years the possibilities of using rubber in the nature of a finishing agent have been explored. The product remains essentially a textile material and is handled by the textile section of the industry. These developments are only in their initial stages.

By the way of introduction to these two sections of the paper it seems worth while making a few observations on raw materials, i.e. textile fibres, and rubber. More particularly the latter since there is not much to be said to a meeting of the Textile Institute regarding textile fibres as such.

A range of textile fibres both natural and synthetic which have varying physical and chemical properties are available to-day and the use to which these various fibres is put depends to some extent on the properties required, although of course, economic conditions also play a part.

Natural rubber occurs in the form of a milky liquid exuded from a particular species of tree. This milky liquid on coagulation yields what we know as raw rubber. This material has elastic properties, but it is extremely sensitive to temperature. It becomes hard and tough when cooled and soft, sticky and very plastic when heated. Even at room temperatures it is in many ways more plastic than elastic, and except as an adhesive in the form of solution it does not find any wide application. To convert this raw rubber into serviceable products it is first of all compounded with various fillers and pigments, and by the addition of sulphur can be made to combine chemically with it under the action of heat to produce vulcanised rubber. This vulcanised material maintains its properties over a wide range of temperatures from  $-40^{\circ}\text{C.}$  up to  $+70/80^{\circ}\text{C.}$  and is very much more elastic and shows only small plastic properties. By variation of the compounding procedure, as well as of the conditions of vulcanisation the rubber chemist and technologist is able to vary the properties over a com-

paratively wide range. The latex, of course, also finds application and prior to the war achieved considerable importance.

The modern conception of the structure of rubber is that it consists of a tangled mass of long molecules. On vulcanisation the cross linking of these molecules takes place with a reduction in the plastic properties, and an increase of the elastic properties. Whilst on this subject attention may be drawn to the analogy between rubber and certain of the textile fibres. This idea has been worked out fairly recently in the case of wool by Harris, Mizell and Fourt. (*Ind. Eng. Chem.*, 1942, 34, 833.)

They draw attention to the striking analogy between vulcanised and raw rubber, on the one hand, and wool before and after the rupture of the disulphide links. They compared the vulcanised rubber with the ordinary wool fibre which consists of long polypeptide chains linked together with the disulphide linkage. The range of elasticity of the wool fibre is very much less than that of rubber, but this is explained by the fact that rubber is a hydrocarbon exhibiting low order molecular cohesion whereas wool contains a large proportion of highly polar groups capable of forming relatively strong molecular interaction.

They were able to show the similarity of unvulcanised rubber to wool fibre in which the disulphide links had been broken by reduction with thioglycollic acid. In a further discussion of the analogy these authors concluded that the influence of heat on the chemical behaviour of rubber is similar to the influence of moisture on the behaviour of wool; moisture swells the protein and decreases inter-molecular adhesion.

A paper by Hermans (*J. Phys. Chem.*, 1941, 45, 827) suggests an analogy between rubber and regenerated cellulose upon deformation and similarly the influence of temperature on the behaviour of rubber is compared to the influence of the degree of swelling in the case of cellulose. Rubber frozen in the stretched condition has a fibrous break, in unstretched state an amorphous break; excessively dried cellulose behaves similarly.

Although these observations are really outside the scope of this paper, it is interesting that structurally textile fibres and rubber are not so widely different.

Finally in the rubber field a new situation is developing with the availability of synthetic rubber of various types, chemically and physically, as supplements to and replacements for the raw product. Also there are available an ever widening range of plastics having rubber-like properties.

It is highly probable, however, that synthetic textile fibres will be developed simultaneously with synthetic rubbers and resins to improve on the one hand the life and general performance of rubber products reinforced with textile material, and on the other hand improve the finish on the essentially textile materials.

## Part I. (W. Knight.)

A rubber compound combining a high degree of tensile strength with comparatively low extensibility and with flexibility can best be produced by the incorporation of a reinforcement external to the rubber mixing. Textile yarns and fabrics lend themselves admirably to this purpose.

As might be expected cotton is by far the most commonly employed textile in the manufacture of rubber products. The American tyre industry alone consumes 270 million pounds weight of cotton annually.

The economic reasons for this predomination will be obvious, but there are in addition, technical advantages.

With the notable exception of rayon, which will be mentioned later, textiles other than cotton are used only in limited applications where their peculiar properties meet special requirements; for example the electrical properties of silk and wool make them of value to the cable making industry, linen is used in the manufacture of hose tubing which is to withstand high internal pressure with the minimum of distortion, jute is used to retard the creep of floor covering and other articles of similar texture, glass textiles in combination with rubber provide filters for the high pressure filtration of hot acids, advantages



are claimed for ramie in certain types of hose, and of course all the textile fibres used for dress goods are found in the waterproof garment trade.

Undoubtedly the outstanding technical advantage offered by cotton is the affinity for rubber which affords a high degree of adhesion between the two. In the past this has generally been ascribed to a mechanical interlocking dependent upon the cotton hairs protruding from the main mass of yarn or fabric and to the natural convolutions of the fibre surface. But modern thought is that chemical composition of the fibre surface plays a part in so far as this determines its hydrophobic or hydrophilic character. Regenerated cellulose and scoured cotton are hydrophilic; on the other hand grey cotton, containing wax, presents a hydrophobic surface for which the rubber will have an affinity.

Whatever the cause, this affinity conveniently allows of the fabrication of cotton textiles and rubber compounds into composite articles in which the differing properties of each have specific functions, and are complementary by virtue of the manner in which they modify each other's physical characteristics.

Consider the requirements of that most familiar of all textile-rubber productions, a modern automobile truck tyre; consisting of 13 lbs. of cotton in the form of six distinct types of fabric, and 48 lbs. of seven differently compounded rubber mixings, with 5 lbs. of high tensile steel wire to anchor it to the wheel. It has to withstand the tractive effort involved in moving a load 35 times its own weight at temperatures commonly reaching 100° C. and at speeds which flex it between cycles of high and low stressing more than 20,000 times every hour, with frequent impacts which involve local stresses which must closely approach the ultimate bursting strength of the tyre. Further we must cater for abrasion wear caused by uneven relative movement between tyre and road, as in rapid acceleration, braking, cornering, or due to slight mechanical defects in the vehicle; provision must be made against the chafing set up between resilient tyre and rigid wheel rim as the tyre is flexed; for the varying degrees of distortion of different parts of the tyre, e.g. beads, sidewalls, and tread; and for dissipation of the heat generated in flexing.

It will be clear that careful choice and control of materials is necessary and that design involves the modification of engineering principles according to experience gained over a period of time in the final and only satisfactory test—the road test. Changes in vehicle design and performance, and the development of non-skid (i.e. less smooth) road surfaces keep the rubber chemists and tyre technicians busily engaged in development work. War-time has presented the many difficult additional problems of producing from substitute materials, tyres capable of carrying heavy and powerful combat vehicles over rough cross-country routes.

The distensible tube in which J. B. Dunlop confined air at higher than atmospheric pressure to absorb the shocks of contemporary street surfaces, required protection from abrasion and cuts and also required a boundary or reinforcement. His solution was to bind the tube to the wheel periphery by means of a fabric bandage (probably of linen). The steps from this crude beginning will be fairly obvious. The ungainliness and inconvenience of the bandage prompted the design of a special wheel shape on which a fabric covered tube might be retained without binding. Protection of the cloth by impregnation with rubber followed logically and the convenience of having the vulnerable inner tube separate from its protective cover for the sake of economical and speedy repair or replacement, would be seen.

Means of attachment to the wheel rim was a limitation to progress until the invention of the Clincher type rim and beaded edge tyre (which was later ousted by the well-base rim and wired edge tyre). It was when the cover became a separate component that its development was facilitated and led to the possibility of applying it to the automobile.

Naturally, existing types of cotton fabric were utilised to supply the foundation of these early tyres and as vehicle performance improved it seemed

logical to search out stronger, denser, and heavier fabrics until the stage was reached where cotton ducks made from combed Sea Island fibre and weighing up to 28 ozs. per square yard were not uncommon, and even these were expected to "blow out" after two or three thousand miles of running. Although the reasons for the failure of such cotton fabrics may now seem obvious it is proposed to survey them briefly at this point.

It is now well known by experience that if two similar sets of parallel threads are arranged in helical form and transversely of each other in the fashion of a tube (e.g. a tyre cover in its inflated shape) and the tube be subjected to internal pressure, the threads will, as far as they are able, adjust their relative positions until they both lie at an angle of  $55^\circ$  (approx.) to the axis of the tube, that is, they will cross each other at an angle of  $70^\circ$ . This is capable of simple mathematical explanation. As the warp and weft of cotton canvas may be woven only at an angle of  $90^\circ$  and built into the tyre at substantially the same angle, it will be seen that considerable distortion of the fabric, and relative movement of warp and weft was set up as the stresses rapidly increased and decreased at any given point in the tyre as it flexed under load during running. In other words there was a violent rubbing action between warp and weft at their intersections, this being aggravated by a sawing effect caused by rapid alternation between high tension and low tension in the interwoven threads, and this rapidly led to breakdown of the canvas and failure of the tyre.

Tyre manufacturers appreciated this point and, by varying the texture and treatment of the canvas, attempted to obtain protective insulation with rubber between the component threads, but with no substantial success.

It was necessary then to produce a cotton fabric in which the warp and weft were not interwoven (if one may use such a contradiction in terms); in which an insulating protective material might be readily and completely introduced between the separate threads; and in which the relative angle between the sets of threads was other than the conventional  $90^\circ$ .

Sloper solved this problem in 1891 by conceiving what was in effect a means of assembling "warp" and "weft" separately, embedding them separately in insulating material, and then assembling them transversely of each other at the desired angle.

The "warp" and "weft", which were required to be exactly the same, were made from a fabric of novel construction now known as tyre cord fabric. This comprises a warp assembly of strong cords held together by the flimsiest practicable weft inserted at one centimetre intervals, only to maintain the warp in order until it might be fixed more permanently by the application of rubber. This material had only a limited popularity in cycle tyres and was not seriously developed for use in motor tyres until the 1914-18 war period when it was popularised in America, reaching this country soon after the cessation of hostilities.

The general form of this fabric has remained unchanged for twenty years but the design and manufacture of the warp threads or cords has become a highly technical and constantly developing business sometimes following and sometimes leading tyre design.

From the early fashion of producing yarns twisted to an optimum tensile strength it was soon seen that the latter must be sacrificed to secure resilience by the insertion of an unusually high degree of twist, and eventually the cable cord evolved, which as its name implies comprises single yarns (23s is a popular count) doubled say fivefold, and the resulting thread cabled threefold in the opposite direction to the previous two twistings. To obtain the desired results, specially heavy doubling frames were designed, and to ensure a stable cord with such a high degree of twist, specially heavy ring travellers and wet doubling were employed.

Unfortunately high twist for resilience involved also high extensibility under load, and although this was argued to be a desirable property it was found also

to involve gradual and permanent elongation of the cords according to the service imposed. As a result the tyre grew dimensionally, and all kinds of complications were possible, for example, the sidewall rubber was flexed while in a state of constant stretch, a condition which quickly leads to surface cracking; splits or cracks were likely to appear at the base of the non-skid pattern, these rapidly growing when flexed; and the tyre generated more heat when running owing to increased distortion. Increase in temperature rendered the cords more susceptible to impact fractures.

It will be appreciated that the work required of the cotton cords under the conditions outlined, is accompanied by the generation of considerable heat which will be aggravated by inter-fibre friction. Running temperatures of 100° C. are common in truck tyres and under severe conditions 140° C. may be reached.

Now cotton yarns lose strength with increasing temperature because contained moisture is evaporated, this presumably reducing the bulk of the fibres and lessening the degree of fibre adhesion. But up to 100° C. or a little higher, this loss of strength is temporary only and is regained as temperature conditions return to normal. Above 115° C. however other effects arise, resulting in rapid and permanent loss of strength, at 140° C. for example it may be permanently impaired to the extent of 40 per cent. in little more than 30 minutes. The effect of a violent concussion on a tyre casing weakened so far by temperature is easily imagined. It is known that loss of strength is deferred by the exclusion of air from the yarn and so the target became a cord of high density, low extensibility, and high twist. High density cords of low twist have up to the present yielded disappointing and erratic results. Six or seven years ago an American tyre cord manufacturer reached the target by treating the component folded yarns under suitable conditions of temperature with penetrants which would soften but not remove the natural waxes and pectins on the fibres. In this condition the folded yarns were cabled into cord, compacted by mechanical means, and the penetrant dried off while the cord was still under tension. This process which was covered by patent produced remarkably improved tyres, and by a variety of means presumably outside the scope of the patent, cords having the same, or similar, characteristics are in regular production and use in this country. A variety of penetrants, compacting devices, and setting means, are in use; in some cases a mere over-twisting followed by tension winding and steam setting has been employed.

For some years past certain of the larger companies manufacturing tyres have been investigating the possibilities of substituting rayon for cotton in tyre fabrics, and they had reached the stage of large scale experimental production.

A specially developed high tenacity viscose rayon was the one with which most progress was made; it was a 275 denier, 120 filament yarn, equivalent in weight to 19s cotton, or in bulk to the commonly employed 23s cotton. This was intended, after folding and cabling to the form 3/4/275-d, as a substitute for the 3/5/23s combed Giza cotton cord then in general use for heavy duty tyre construction. Comparison of certain of the properties of the two types of cord will show that the value of rayon lies in that its strength, unlike that of cotton, increases as temperature rises, within certain limits.

	Strength at Commercially		
	65% R.H.	Dry.	at 140° C.
3/4/275 Viscose Rayon	16 lbs.	19 lbs.	20½ lbs.
3/5/23 Combed Cotton	23½ lbs.	20½ lbs.	16½ lbs.

At the rayon cord would have only 12/15 of the diameter of the cotton cord it was possible to increase the number of cords in the width of the fabric to give the latter, strength equal at least to the cotton fabric when commercially dry, and 40 per cent. superior at 140° C.

Economic objection to the use of rayon was readily countered by the anticipated improvement in tyre life, and the main technical difficulties for the tyre manufacturer were associated with the hydrophilic character of rayon.

A primary impregnation with rubber was obtained by applying water dispersions of rubber (i.e. latex) with which was mixed resin forming chemicals; these combine during drying and vulcanising to give a non-thermoplastic bond between cord and rubber. As would be expected, very careful control of stretching of the material and of its moisture content throughout processing was essential.

Until 1941, rayon fabric tyres were advocated by their manufacturers only for use under unusually severe conditions involving long continuous runs, at high speeds, and with heavy loads, that is, under conditions conducing to unusually high temperature build up in the tyres, no advantage over cotton fabric tyres under average conditions was claimed.

The failure of supplies of rubber through enemy action in the Far East and the consequent necessity to use synthetic rubber in tyres has offset the advances made in tyre cord design, because synthetic rubber has a higher inherent hysteresis loss than the natural material and so generates considerably more heat under conditions of flexion.

The necessity has therefore arisen to design a cord having even greater heat resisting qualities, and requiring a smaller volume of rubber or similar insulating material.

While the relative merits of a finer (2/1100 denier) viscose cord and a 3/4/23s combed Giza cord are still the subject of discussion and experiment in this country, the position in America is a little obscure although it is known that the American military authorities have satisfied themselves of the superiority of rayon over the 3/5/23s type of cotton for aircraft tyres, and the more severely stressed military vehicle tyres, and that an enormous expansion of rayon production has been ordered.

There is the serious implication of a complete change from cotton to rayon in the near future and it may be of interest to quote, in part, from an address given some months ago by Dr. C. T. Murchison, president of the Cotton Textile Institute (America). He said: "This development promises to wipe out at one stroke 10 per cent. of America's normal peace-time consumption of cotton. I express no judgment whatever as to the merits of the decision. But I can say that it involves fierce controversy and a deplorable lack of scientific evidence. Cotton was put on the defensive in this instance and may have lost a major battle in its history, not necessarily because it was inferior for a given purpose but because it did not have the verified facts of the type which were essential to win its acceptance under the prevailing circumstances. Science, working impartially and unfettered on this problem; might have saved the American farmer and the American industry untold millions."

It does not seem possible that such an authority should not be familiar with means already developed and well known in this country for chemical modification of cotton yarns to improve their tendering under conditions of high temperature. For example acetylated cotton yarns retain 90 per cent. of their original strength after being subjected to 140° C. in air for 100 hours continuously. No doubt this line of investigation is engaging the attention of British tyre technologists.

The present high standard of performance of "rubber friction" transmission belting is a tribute to free co-operation between textile manufacturer and rubber manufacturer.

These belts are constructed of strong, closely woven, cotton ducks now happily standardised in this country as to construction and weight, and manufactured to close physical limits of a standard considered impracticable twenty years ago. Manufacture of the belt is fairly straightforward; the moisture content of the duck is reduced to a minimum and plastic unvulcanised rubber compound of high quality is forced through the interstices of the fabric by means of a heavy calender, so that as much as possible of each component thread is coated with rubber insulation. The material is then very accurately slit into warpway strips of predetermined width suitable for folding into the number of plies calculated to meet particular conditions of service.

The resulting belts are then stretched to any desired degree and vulcanised between the steam heated platens of powerful hydraulic presses whilst still under tension.

Rubber transmission belting was first able to compete with leather belting because of its lower price, and because of the relative scarcity of suitable hides. But it has since proved its superiority under trying atmospheric conditions, in the presence of steam, heat, acid fumes, etc. It took many years to educate the consumer to the new technique and to dissuade him from using standard leather belt dressings which reduced the efficiency of the belt and had a fatal effect on the rubber surface.

The very high coefficient of friction of rubber-surfaced belting is the feature contributing most to its high technical efficiency. Unfortunately this raises the difficulty that when heavy overloads are met, the very efficiency of the belt prevents any appreciable slippage between belt and pulley and the former is forced to accept the overload, and for this reason must be made considerably stronger and heavier than is required to withstand normal stresses of driving.

To meet fully the requirements of transmission belting the cotton duck must be designed around three main features; first the warp threads must be capable of carrying the transmission loads with a very high safety factor, secondly, the warp must retain its elastic properties in service without developing permanent extension by fatiguing of the cotton, and thirdly, the weft threads must be of such strength and arranged in such a manner as to hold the belt fasteners firmly when the belt is under load.

The tensile strength of the duck warpway is always ample because it is necessary to specify a high strength in order to keep extension under load as low as possible to ensure maximum elasticity and minimum fatigue effect. It is with this object also that the belts are stretched during vulcanisation to remove a major part of the warp crimp. However, this is most carefully arranged because a certain degree of warp crimp must be retained to provide a friction lock on the weft threads to hold fasteners in position. The most common cause of failure of this type of belting is the tearing out of the fasteners and wherever possible the manufacturers would prefer to make an endless belt to suit each particular case, by stitching a spliced joint and vulcanising it in a "swan-neck" press.

The development of methods of producing endless vulcanised belts and the experience gained with tyre fabric have made possible the technique of manufacturing V rope belts which must by now constitute a serious rival to chains for heavy drives between short centres. These ropes have as their main element multiple wraps of a single cord, usually cotton, and having the characteristics of tyre cord, namely, high density, low extensibility and a high degree of elasticity and resilience.

Mention must be made of conveyor and elevator belting which is made on exactly the same lines as transmission belting, being generally much longer and wider and having a protective covering of tough rubber. Every day conveyor belting is performing Herculean tasks of transportation in coal mines, quarries, etc.

One may have read of the work done by the conveyor belts now in operation on the Shasta Flood Control Dam across the Sacramento river in the United States of America. They are transporting rock and other materials over a distance of ten miles, and to an elevation of 1350 feet at a rate of 22,000 tons per day. Ten million tons of material will be conveyed in four years.

Textile materials are used in the manufacture of delivery hose, and vacuum and pressure resisting hose in all three of the familiar forms, fibre, yarn, and woven fabric. Fibre is used only as a stiffener and toughener in flexible connections in water cooling circuits, for example for automobiles, when irregular shapes make difficult the use of mass production methods possible with yarn or fabric.

Rubber lined hose has proved so useful and versatile a servant that the variations of quality, length, bore, thickness, stiffness, bursting strength, etc., cover many hundreds of types. As extremes one may instance the few inches of piping upon which modern automobiles depend for smooth and powerful hydraulic braking, and the large bore suction hose to withstand the vacuum dredging of river beds. In the first case a bore of perhaps only  $\frac{1}{8}$ " is required, but with a bursting resistance of up to 10,000 lbs. per square inch and with minute but precisely defined change in dimensions at such pressures. In order to ensure the security of the end couplings at high pressure, the overall diameter of the article must be correct to a very few thousandths of an inch. On the other hand the dredger hose may have a bore of 15", it will not be called upon to withstand any pressure, but it must not collapse under vacuum; its inner surface must be smooth to reduce to a minimum the friction of the material conveyed, and tough enough to remain smooth after passing silt, gravel, etc.; its outer surface must be equal to the abrasion met in dragging over river beds.

In brief and in general the character of the textile materials used in manufacturing so wide a range of types depends (apart from performance requirements) upon the manufacturing method, which in turn is governed by the diameter and length required. Broadly speaking, hose of a quarter inch or less in bore for high performance would be made in lengths of a few feet only supported on steel mandrils on braiding machines employing yarn, hose over  $\frac{1}{4}$ " bore and up to 6" could be produced from cotton ducks in lengths up to 60', above 6" in bore hose is made from cotton duck with helical wire support, and the manufacturing length must be reduced progressively with increasing diameter because of the problems of manipulation.

However, the most logical and technically correct method is that of braiding one or more layers of yarn over a prepared rubber tube. By this means hose up to 1 $\frac{1}{2}$ " in bore may be made in continuous lengths of up to 500', the length limit being fixed only by the size of the plant available and by economic considerations.

From a bewildering range of fabrics The British Standards Association in co-operation with interested bodies has developed and specified in detail 11, varying in weight from a 2 $\frac{1}{2}$  oz. per square yard sheeting, to a 22 oz. per square yard duck, to cover the whole range of wrapped hose requirements. It is desired that the structure of the fabric should be what is termed "square," that is its strength-stretch characteristics must be the same in the directions of both warp and weft, after it has undergone the stresses of processing with insulating rubber, so that an intelligent balancing of ends per inch and picks per inch, warp and weft crimp, and selection of yarns, is necessary in designing the cloth.

Braiding yarns vary very considerably in type according to the performance required of them. They may be of cotton, flax, ramie, or hemp and are required to be wound in compact cheeses, multiple ends together for loading directly on to the braiding machine carriers. They are commonly of counts equivalent to 10s cotton, folded and cabled to four or six fold and wound up to 6 ends parallel.

As far as possible they are pitched in braiding to be at an angle of 55° to the axis of the hose for reasons already outlined in discussing tyre construction. Since the diameter of the hose increases with each ply of braiding added, it is necessary to increase braiding pitch to maintain the 55° angle, and because this would open the texture of braiding, the number of ends per cheese or the number of cheeses employed, is increased to give compact cover.

Obviously yarns of maximum strength, minimum extension, and the highest possible density are the ideal. To a very small extent, limited by the patent position, yarns are also built into hose in the form of unwoven fabric by a method of adhering parallel yarns together to form tapes of accurate width which are wound helically on to a prepared foundation so that their edges

abut exactly and unite under the pressure of vulcanisation. By this means a product having maximum resistance to flexion, and minimum change of dimension under pressure is produced.

As has already been indicated it is not intended to catalogue all the articles in which textiles contribute to the functioning of the rubber manufacturer's product, but it would not be out of place to remind you of some of the more common.

Textiles are used in the reinforcement of hollow goods such as hot water bottles, cushions, air brake components, etc.; of surgical sheeting, ground sheets and protective clothing; as a cover for tennis balls, as a component of leather cloth, imitation suede, etc.; for printers' offset blankets; in the manufacture of battery separator plates; for clutch linings; and even in fibre or flock form as a compounding ingredient in vulcanite and in rubber where high resistance to wear is required.

## Part II. (C. M. Blow.)

As indicated in the introductory remarks, the subject to be dealt with is the use of rubber as a finishing agent, which is among the most interesting recent work on the application of rubber in the textile field. For the sake of completeness, however, brief reference to certain of the other applications of rubber will be made.

Elastic thread has been used for many years and could of itself form the subject of a lecture. This subject is really outside the scope of this paper.

Considerable use has been made in recent years of rubber latex in the manufacture of carpets and pile fabrics generally. The rubber latex which may be compounded is applied to the back of the carpet and has the effect of replacing the sizing treatment and imparting considerably more anchorage to the pile than is obtained by the latter substance. This technique has been developed considerably in America and is used also in this country. It is customary to simplify the weave structure of the carpet and use rubber latex to make up for the loss of mechanical lock of the pile. A further development which originated in America and which has been worked successfully in this country employs rubber latex spread on to a hessian backing as the sole means of holding the pile. The pile fibres are carded into a web which is processed into a folded structure and cemented to the hessian. It is afterwards cut, and although the density of pile is very much less than the normal pile carpet it has found considerable application for carpeting motor cars, 'buses, etc. One of its advantages is that it can be cut without fraying. In the same way the backing of plushes has been carried out with considerable success and in this case the material has also waterproof qualities. Another interesting point in this connection is that such rubber backed upholstery fabrics appear to be unattacked by moth.

Another application of rubber latex is in the laying of surface fibres. The problem is of importance in the case of the jute pack, in which foodstuffs and various materials, including wool, are packed. This has a tendency to shed fibres which get mixed into the contents of the bag, and this problem which has been to the fore for a good many years appears to be easily solved technically, but economic considerations have limited its applications.

Although paper is hardly a textile fibre reference may be made also to the use of latex in connection with paper making and paper finishing.

Two main methods of employing latex have been developed. In the first the rubber latex is incorporated in the pulp from which the paper is made and this has reached commercial production, although its adoption has only been on a very limited scale. The main advantages claimed are that the paper resists creasing and has increased wet strengths. It is, however, stated that the rubber reaches a state of oxidation very rapidly and that there can be little unoxidised rubber in the paper shortly after it is made.

The impregnation of the finished paper with rubber latex has been explored to some extent, and particularly in America very satisfactory artificial leathers

are made from paper impregnated with specially compounded rubber latex and given a surface finish of varnish or synthetic resin. The required appearance is obtained by mechanical embossing of the surface.

The patent literature contains many references to the impregnation of felts with rubber latex to impart stiffness and render them usable in shoe manufacture, etc. For this purpose, needled jute felts are usually used, but carded cotton has been used. The binding of coarse fibres, e.g. horse hair, with latex, to produce upholstery stuffing has reached commercial importance with the production of "Hairlok."

One may also mention the use of latex with glass fibre.

In the field of rovings and yarn and fabrics, several papers and many patents have appeared dealing with their impregnation by rubber latex. The "Filastic" yarn composed of 50 per cent. fibre, 50 per cent. rubber, is an interesting product which has found application in the manufacture of belting, etc., and a high degree of penetration is obtained by impregnation on the spinning frame or in conjunction with the spinning operation.

Generally speaking, however, few of these processes have been developed and this can be attributed to the fact that they destroy more or less the textile characteristics.

The fundamental problem, therefore, of using rubber latex as a finishing agent remains to be considered. The use of rubber latex as a finishing agent is in fact only part of a much wider and more general subject which is very much to the fore at the present time. Finishes in general may be classified into temporary and durable and rubber latex naturally falls into the second class and should be considered alongside cellulose ethers, synthetic resins and starches fixed by resinous material.

With the advent of synthetic rubber having special properties the border line between the rubber finish and the resin finish is likely to become less and less marked. The possibility of causing the rubber to enter the actual fibre is very remote. In the case of natural rubber it appears quite definitely that this cannot occur purely on account of the particle size of the rubber and the pore size of the fibre. This, in general, will apply to all emulsions of natural and synthetic rubbers. The formation of synthetic rubber and/or resin actually inside the fibre has already been achieved by the well-known Tootal process, and it is worth while pointing out the possibility that some copolymerisation of monomers to produce synthetic rubber-like resins *in situ* may be achieved. Attempts have been made to incorporate rubber latex in the cellulose solution prior to spinning into yarn, but no great commercial exploitation of this process seems to have been carried out up to the present.

The broad fact stands out that rubber is ideally suited as a finishing agent for textile material since it has good binding qualities, is not water soluble, is flexible and is not broken down into powder by mechanical treatment. The rubber applied either from solution or from latex is film forming with the result that a straightforward treatment of either yarn or fabric with rubber latex gives a rubbery skin to the material which is highly objectionable. Obviously more subtle means of treating textiles with latex are required and certain progress was made in the years prior to the war along these lines. The first point concerns the wetting of the textile material by rubber latex. Rubber latex has extremely poor wetting properties and even if a considerable quantity of ordinary wetting agents of the soap type are added, the wetting is not increased to a marked extent since these materials are considerably adsorbed on the surface of the rubber particle in preference to the water-air interface.

Rubber latex is alkaline and the particles of rubber in that latex are negatively charged. Textile fibres in contact with alkaline liquids are also negatively charged, and so added to this difficulty of wetting there is definite repellent action between the particles of rubber and textile fibres.

Three major difficulties, therefore, have to be overcome in producing a successful finishing treatment employing rubber latex. Firstly, the textile has



to be made wettable by the rubber latex. Secondly, the repulsion of the rubber particle by the textile fibre on account of similarity of the electrical charge has to be overcome, and finally it is essential to avoid a dried film of rubber over the yarn or fabric. In America, in April, 1940, Teague published several papers describing his patented (no number given) method of overcoming these difficulties. His method is essentially to deposit rubber onto wool from the "iso-electric" latex; protective colloids and surface active ingredients enable the "iso-electric"  $pH$  to be shifted. The properties imparted are increased wear, mothproofing, improved laundering and good handle.

Work carried out in this country sponsored jointly by Wool Industries Research Association and the British Rubber Producers' Research Association led to some interesting results which were the subject of patents and publications from 1936-1940. This work was primarily concerned with wool—a fact which influenced the course of the research.

Wool has certain valuable and unique properties and any application of rubber should, therefore, be aimed at preserving as much as possible these desirable qualities.

Taking as a starting point the necessity of eliminating the similarity in electrical charge, the use of cationic soap materials was investigated. These soaps of which the surface active portion of the molecule is positively charged were developed as auxiliaries in dyeing and are adsorbed by textile fibres to give a positive charge even in alkaline solutions. The textile material, so treated, is, comparatively speaking, easily wetted by ordinary alkaline rubber latex and the particles are deposited on the textile fibres. Examination of the material so treated shows clearly that with a deposited film of rubber the handle is only slightly affected even though the same amount of rubber may be present as when applied in the form of a dried film.

Normal alkaline latex is flocculated by cationic soap solution—two interesting features of this flocculation are: firstly, the  $pH$  is not appreciably altered, and secondly, excess of the cationic soap produces no flocculation.

These observations led to a fuller investigation of the behaviour and characteristics of rubber latex treated with these cationic soaps.

As a result of this work it was possible to express diagrammatically the surface constitutions of rubber latex particles variously treated. The practical outcome of this rather academic work was the production of a positively charged latex. This positively charged latex is entirely different from the positively charged latex that can be produced by simply acidifying natural latex which contains protein as a protective colloid for the particles.

As is obvious, there is a converse process, the use of an anionic soap stabilised acid latex with negative particles capable of depositing on to positively charged wool fibres. Such a process does work although the efficiency is lower than the other process—wetting being less and deposition reduced.

It is interesting to refer to a paper which appeared in the Transactions of the Institution of Rubber Industry last year by Dr. Piper. He states that the formation of a skin can be avoided and satisfactory impregnation obtained by methods using negative latex. This is contrary to the results published and Dr. Piper does not give any data, e.g. on wetting, to support his contention.

The positively charged latex obtained by the use of cationic soaps maintains its charge up to a  $pH$  of approximately 11, and deposits its particles on the textile material brought into contact with it. A fairly full description has been published elsewhere of the methods of handling this latex and the properties imparted to the textile material so treated. It can be used very dilute and applied to hank and cheese in dyeing machinery. The liquor is exhausted of rubber in a manner similar to a dyestuff.

The function of the rubber latex is as a bonding agent for the textile fibres. The fibres being coated with rubber have a less tendency to slip one over the other and therefore shedding of fibres in such cases as carpets and plushes is entirely eliminated. In the case of knitted and woven fabrics of loose structure

which tend to shed fibres in the form of surface pills show considerable reduction in this defect and considerable increase in wearing properties. This work was largely interrupted by the outbreak of war and has been still further restricted by the interruption of rubber (in particular, latex) supplies. It may be remarked, however, that satisfactory artificial dispersion of rubber carrying a positive charge and depositing in a similar way to the latex material has been achieved.

In applications employing rubber the question of the perishing of the rubber is invariably raised, and some comments must be made on this particular aspect. In the first place antioxidants have been developed and considerable life is given to rubber by their use and applications in manufacture. A latex thread may be instanced as a rubber product that is widely used in textile fabrics, and has been found to give reasonable life. There seems no reason why rubber used as a finishing agent should not also have a fairly extended life. Nevertheless, it has been found that some oxidation of the rubber does occur and chance contamination with copper has a very marked influence. The saving grace, however, is that the oxidised rubber which, of course, is no longer flexible but resinous is removed by simple washing treatment. One can visualize further developments of this process in the future employing either modified rubber or synthetic rubber which will have extreme resistance to oxidation. There is a tendency also to develop synthetic rubbers suited to particular applications. There are available oil resistant rubbers, rubber that is resistant to abrasion and so on, and there does not seem any reason why there should not be developed a rubber highly resistant to oxidation which would be the ideal material for use as a finishing agent for textile materials.

A warm vote of thanks was given to the two lecturers, moved by Mr. W. E. Boswell, and supported by Mr. W. Pollard, and the meeting closed with a vote of thanks to the chairman, proposed by Mr. A. S. Greenwood, and seconded by Mr. W. A. Dutton.

## General Items

### Addition to the Library

The following book has been received in the Library:—

*Transactions of the National Association of Cotton Manufacturers, 1933-1942, U.S.A.*

### Employment Register

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application.

No. 233—Young man, age 31 years, desires position as Manager in Narrow Fabrics or Hosiery Manufacture. A.T.I. 10 years' experience in all branches of Narrow Fabrics. Practical experience of mill management in all departments. Exempt from military service.

No. 234—Chemist (39), M.Sc.Tech., F.T.I., desires to take up a position where full use could be made of his wide experience in the practical finishing of cellulosic fibres as well as in fundamental and technical research.

**TECHNICAL MANAGER** required for the Government of Cyprus Cotton Spinning factory for the duration of the war with possible extension. Salary £720 a year, plus £72 housing and lighting allowance. Free passage. Candidates should be capable of supervising the installation of the Mill Machinery and subsequently performing the duty of Technical Manager of the Mill. Write stating age and full particulars of qualifications and experience to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1., quoting M/N/11930.

## Books for H.M. Forces

From time to time the Institute receives inquiries for technical books to enable members of H.M. Forces to study textiles. The Council of the Institute appeals to members, therefore, to send any textile books which they can spare to the

Acting General Secretary,  
The Textile Institute,  
16, St. Mary's Parsonage,  
Manchester, 3.

The books would then be despatched to interested members of the Forces who could make use of them. These students are at all stages of study and the following list of books gives some indication of the type which is required. The list, however, is not exhaustive and other books of a similar nature would be welcomed.

- Astbury, W. T.—*Fundamentals of Fibre Structure* (Oxford University Press).  
Balls, W. L.—*Studies of Qualities in Cotton* (Macmillan).  
Bean, P.—*Chemistry and Practice of Sizing* (Kirkham and Pratt).  
Carter, H. R.—*Modern Flax, Hemp and Jute Spinning and Twisting* (Greenwood).  
Chamberlain, J.—*Knitting Mathematics and Mechanisms* (College of Art and Technology, Leicester).  
Chamberlain, J.—*Hosiery Yarns and Fabrics* (Hemmings and Capey).  
Cooper, F. J.—*Textile Chemistry* (Methuen).  
Davis, W.—*Hosiery Manufacture* (Pitman).  
Fox, T. W.—*The Mechanism of Weaving* (Macmillan).  
Hanton, W. A.—*Automatic Weaving* (Benn).  
Haven, G. B.—*Industrial Fabrics* (Wellington Sears).  
Lawrie, L. G.—*Textile Microscopy* (Benn).  
Lomax, J.—*Textile Testing* (Longmans Green).  
Matthews, J. M.—*The Textile Fibres: Their Physical, Microscopical and Chemical Properties* (Wiley).  
Merrill, G. R.—*American Cotton Handbook* (American Cotton Handbook Co.).  
Morton, W. E.—*An Introduction to the Study of Spinning* (Longmans, Green).  
Nisbet, H.—*Preliminary Operations of Weaving*, 2 Vols. (Emmott).  
Preston, J. M.—*Modern Textile Microscopy* (Emmott).  
Priestman, H.—*Principles of Woollen Spinning* (Longmans, Green).  
Read, J.—*Elementary Textile Design and Fabric Structure* (Arnold).  
Roberts, T.—*Tappett and Dobby Looms* (Emmott).  
Schober, J.—*Silk and the Silk Industry* (Constable).  
Thornley, T.—*Cotton Spinning* (Benn).  
Tippett, L. H. C.—*The Methods of Statistics* (Williams and Northgate).  
Wakefield, S.—*Cotton Doubling and Twisting* (Nichols).  
Watson, W.—*Advanced Textile Design* (Longmans, Green).  
Watson, W.—*Textile Design and Colour* (Longmans, Green).  
Wheeler, E.—*The Manufacture of Art. Silk* (Chapman & Hall).  
Woodhouse, T.—*The Preparation and Weaving of Artificial Silk or Rayon* (Pitman).

## Institute Membership

The following applicants were elected to membership at the January meeting of Council:—

### Ordinary.

- Thomas Anderson, 3, Lock View, Bingley, Yorks. (Chief of Inspection and Progress, Driver, Hartley & Co. Ltd., Dryart Mills, Keighley).  
Percy Lawrence Braithwaite, Rock House, Cromford, Derbyshire (Chemist, Amoa Chemical Co. Ltd., Coventry Road, Hinckley).  
Walter Henry Briggs, 13, Denham Avenue, Alverthorpe Road, Wakefield, Yorks. (Top and Yarn Testing, Alfred Haley & Co. Ltd., Westgate Common Mills, Wakefield).

- Norman Crosland, 1, Marshall, Alloa, Scotland (Assistant Mill Manager, Patons & Baldwins Ltd., Kilncraigs Factory, Alloa).
- John Henry Dobson, "Bredon," 133, Bewdley Hill, Kidderminster (Carpet Trades Ltd., Kidderminster).
- Frank Harrison, 1027 Allard, Verdun, Montreal, Prov. Quebec, Canada (Textile Technician, Bruck Silk Mills, 460, St. Catherine Street, Montreal).
- Conrad William Jorgensen, 4, Melbourne Place, Bradford, Yorks. (Night Weaver, Home Silks Ltd., Horton Bank Top, Bradford, Yorks.).
- John Kellett, Lincoln Mills (Australia) Ltd., Gaffney Street, Coburg, No. 13, Victoria, Australia.
- Henry Merritt, 6, Fairfield Crescent, Staincliffe Road, Dewsbury, Yorks. (Technical Dyer).
- Alfred Leslie Mollett, Samuel Cockroft & Co. Ltd., Barkerend Mills, Bradford, Yorks. (Company Director).
- Albert Sharpe, 35, Southbank Street, Leek, Staffs. (Hosiery Manager, Brough Nicholson & Hall Ltd., Leek).
- Percy Edward Stanhope, F.I.C., The Manse, Dundee Lane, Ramsbottom, Nr. Manchester (Rayon Dyeworks Manager, T. Robinson & Co. Ltd., Hope-works, Ramsbottom).

#### *Junior.*

- Hugh Aldred, B.A. (Cantab.), Dyehouse Dept., Hexagon House, Blackley, Manchester, 9 (Chemist—Textile Finishing, I.C.I. (Dyestuffs) Ltd., Manchester).

### **Obituary**

The Institute regrets to announce the death of the following members:

J. W. BARON, Great Harwood.

J. M. HEY, Swinton.

J. S. ADDISON, Braintree.

## **INSTITUTE MEETINGS**

### **IRISH SECTION**

- Wednesday, 2nd February, 1944—Joint meeting with the Belfast Association of Engineers. 6.30 p.m. Lecture: "Damask Weaving," by F. J. W. Shannon, F.T.I., at the College of Technology, Belfast. The lecture will be illustrated with lantern slides.
- Tuesday, 15th February, 1944—Lecture: "Industrial Water Treatment," by T. A. Cooper, Imperial Chemical Industries Ltd., at the College of Technology, Belfast, at 7.0 p.m.

### **LANCASHIRE SECTION**

- Friday, 11th February, 1944—Lunch-time meeting—1.0-2.0 p.m. Lecture: "Rings and Travellers," by Donald Eadie, Eadie Bros. & Co. Ltd., at the Institute's premises.
- Tuesday, 29th February, 1944—Lecture: "Costing for the Textile Industry," by H. M. Broadley, Richard Haworth & Co. Ltd., Salford, at the Municipal College, Burnley, at 6.45 p.m.

### **MIDLANDS SECTION**

- Saturday, 19th February, 1944—Lecture: "Colour and Design in Textiles," by J. C. H. Hurd, F.T.I., at the College of Art and Technology, Leicester, at 3.0 p.m.

### **YORKSHIRE SECTION**

- Thursday, 17th February, 1944—Lecture: "Comparable Results obtained during Wet Processing of Wool and Cotton and some Unusual Defects," by F. Brayford, at 6.30 p.m.

# THE JOURNAL OF THE TEXTILE INSTITUTE

Vol. XXXV

FEBRUARY 1944

No. 2

## PROCEEDINGS

### Annual General Meeting

The Annual General Meeting of the Institute will be held at the Midland Hotel, Manchester, on Wednesday, 19th April, 1944. The programme for the day will also include a Luncheon, the Mather Lecture and Afternoon Tea. Full details of arrangements will be supplied to members in the near future.

### Mather Lecture

The Mather Lecture, which is to be held in conjunction with the Annual General Meeting, will be given by Professor G. D. H. Cole. His subject will be "Educational Reconstruction with some Special Reference to the Textile Industries."

### Chairman of Council

Mr. J. E. Dalton, who has been Chairman of the Council since May, 1943, has recently tendered his resignation from the Council and from all Committees because of health reasons. The members of Council have accepted the resignation with great regret. Mr. Dalton has served the Institute in many capacities over a long period, and his presence will be greatly missed. He still remains as a member, however, and his advice will always be available. The vacancy created on the Council will not be filled until the Annual General Meeting.

Mr. H. G. Greg, who was the Vice-Chairman, was unanimously elected as Chairman of the Council at the February meeting.

### Election of Officers, 1944

Normally ten members of Council retire annually, but in 1944, because of casual vacancies which have occurred during the year, there will be twelve vacancies. The names of those due to retire are shown in the following list, and in addition there are two other vacancies which occurred recently and which will not be filled until the Annual Meeting.

C. H. Colton (Manchester)

E. J. Poole (Bradford)

H. G. Greg (Styal)

R. J. Smith (Manchester)

H. Hardy (Morley)

J. B. Speakman (Leeds)

R. Lord (Lancaster)

A. J. Turner (Belfast)

F. Pickles (Leeds)

H. A. Turton (Nuneaton).

It has been decided that if a ballot is necessary, the first ten candidates who are elected shall serve for a period of three years, the eleventh candidate for a period of two years and the twelfth candidate for a period of one year.

Election takes place at the Annual General Meeting, and nomination forms are being supplied to members of the Institute so that nominations for the twelve vacancies occurring in 1944 may be made.

The Council has nominated Mr. T. H. McLaren, of Dundee, for election as President for the year 1944-45. Mr. F. W. Barwick (Manchester), Mr. F. Kendall (Shipley), and Dr. J. C. Withers (Manchester) have been nominated for election as Vice-Presidents.

### Institute Membership

The following applicants were elected to membership at the February meeting of Council:—

#### *Ordinary.*

- Frank Bailey, Messrs. Frank Bailey Ltd., Beechwood Mills, Ovenden, Halifax (Dyer and Finisher).
- Robinson Buck, A.C.A., B.Com.Sc., Robert R. Buck & Sons Ltd., Nelson Street, Carlisle (Textile Manufacturer).
- P. F. Burns, 6, Marine Drive, Fairhaven, Lytham, Lancs. (H.M. Inspector of Schools).
- Brindley Jack Brown, A.M.C.T., 24, The Oval, Heald Green, Cheadle, Cheshire (Research and Development Executive, Thos. French & Sons Ltd., Chester Road Mills, Manchester, 15).
- Fuller E. Callaway, Junr., Callaway Institute Inc., LaGrange, Georgia, U.S.A. (President, Callaway Mills, LaGrange, Georgia, U.S.A.).
- Brian Greaves Campbell, 7, Redburn Avenue, Shipley, Yorks (Director and Sales Manager, Allied Colloids (Bradford) Ltd., Valley Road, Bradford, Yorks.).
- Joseph Henry Chapman, "Mayfield," 9, Clifton Grove, Mansfield, Notts. (Chief Engineer and Technical Adviser, Forster, Clay and Ward, Mansfield).
- J. Clarke, 2, Lucknow Drive, Mansfield, Notts. (Maintenance Mechanic, Quortex Ltd., Mansfield).
- Reginald Garner, 6, Sparthfield Avenue, Rochdale (Head Salesman, Wilson & Co. (Barnsley) Ltd., Barnsley).
- William John Hopkins, 232, Hoo Road, Kidderminster, Worcestershire (Assistant Manager, S.A.A. (Components), Carpet Trades Ltd., Kidderminster).
- Ronald L. Kitchen, 2, Mount Street, Cowlersley, Huddersfield (Dyer, John Kaye & Son (Huddersfield) Ltd., King's Mill, Huddersfield).
- Charles B. Ordway, B.S., M.S., 2712, Roswell Avenue, Charlotte, N. Carolina, U.S.A. (Textile Chemist, American Aniline Products, Inc., 301, East 7th Street, Charlotte, N.C., U.S.A.).
- James Jackson Sanderson, 6, Beechwood Avenue, Stanwix, Carlisle (Textile Factory Manager, Robert R. Buck & Sons Ltd., Nelson Street, Carlisle).
- Maurice Schofield, 1, Clough Park Avenue, Grasscroft, Greenfield, Nr. Oldham (General Manager, Buckley & Co. (Greenfield) Ltd., Kinders Mill, Greenfield, Nr. Oldham).
- Charles Smith, c/o Dunbar Mills, Shamnagar, B. & A. Rly., Bengal, India (Weaving Master).
- Philip Walter Smith, B.Sc., Ph.D., 203, Park Road, Bolton (Chemist & Dye-stuffs Technician, Imperial Chemical Industries Ltd., Hexagon House, Blackley, Manchester).

George Johnson Warburton, "Sunnyside," Roscow Avenue, Breightmet, Bolton (Spinning Manager, Vantona Textile Ltd., Moor Mills, Parrot Street, Bolton).

*Junior.*

Reginald George Barr, 7, Union Street, Portadown, Co. Armagh, N. Ireland (Apprentice Factory Manager, Wm. Ewart & Son Ltd., Tavanagh Factory, Portadown).

Brian Eatock, 203, Belmont Road, Astley Bridge, Bolton, Lancs. (Student, Manchester College of Technology).

Jacob Gitkinas, 181, Legrams Lane, Lidget Green, Bradford, Yorks. (Designer and Production Clerk, David Pike & Co. Ltd., Ebor Mills, Bingley, Yorks.).

## Diplomas

Elections to Fellowship have been completed as follows since the appearance of the previous list (December issue of the *Journal*):—

MILTON HARRIS, B.Sc., Ph.D.,

Director of Research, Textile Foundation, National Bureau of Standards, Washington, D.C., U.S.A.

ALEXANDER MELVILLE, M.I.Mech.E.,

Chief Engineer, Standish Co. Ltd., Wigan.

## John William Nasmith (1860-1943)

J. W. Nasmith, Honorary Fellow of this Institute, can be said to have been nurtured in the textile machine industry. His father, John Nasmith, who came originally from Ecclefechan and was born within about 300 yards of the birthplace of Thomas Carlyle, joined the firm of John Hetherington & Sons, Ltd., some time in the 1840's. In 1851 he patented an improvement on the Heilmann comber, and was, at that time, a foreman in the firm of John Hetherington. J. W. Nasmith served his apprenticeship at John Hetherington's and subsequently after serving for some little time in Italy, went to reside at Mulhouse in Alsace, from which centre he travelled the Continent and sold Hetherington's preparatory and spinning machinery. Even while he was doing this he was inventing, but did not invent anything material in relation to a textile machine. Still it showed his trend, and all the time he was located in Mulhouse, until 1900 or 1901, he was perfecting the invention with which his name has been subsequently connected, namely, a very revolutionary improvement on the old Heilmann type of comber. It was in 1901 that he took out his first patent (B.P.13,758, July 6th, 1901) for the Nasmith comber and ever since that date until the time of his death, he was perfecting the machine, improving it and applying to it further inventions which were the subject matter of a number of patents. It was only a day or two before he died that he completed some further improvements in connection with combing mechanism. He also made some inventions in relation to a wool comber as distinct from a cotton comber, and no doubt at a later date we shall hear something about this. The writer is given to understand that it has been already subjected to trials.

Subsequent to the date he took out his first patent he interested himself in other matters, particularly in box-making machinery, and he certainly invented an automatic machine which was a big advance on anything that had been previously produced, because most of these machines came from Germany in the first place. He also invented some steam appliances, particularly the Nasmith steam trap in which he employed the principle of the "lazy tongs." In addition, he made himself a master in the use of the slide rule and wrote a very concise and informative little text book on the instrument.

He was educated at the Chorlton High School under John Angell, and perfected himself in Latin so that at a later date, as he said himself, he easily acquired a command of foreign languages, particularly French. His residence in Germany also enabled him to perfect his knowledge of German.

He was an extremely active individual all his long life and even up to a few days before his death he was busy in the workshop at his residence, in applying certain new ideas to his already very much improved type of combing machine. He stated quite candidly when the Honorary Fellowship was presented to him in 1931\*, that he was imbued with two ideas, one to make a little money for himself, and the other to present to the Industry a machine which would be an improvement on anything that had yet been introduced and would give higher production and a better quality of product. He achieved both objects and he was very definitely proud of the fact that the Textile Institute thought him worthy to be numbered amongst the men on whom they bestowed the Honorary Fellowship.

FRANK NASMITH, F.T.I.

Undoubtedly so far as the cotton spinning world is concerned the name of Nasmith is welded into history. No one ever exercised so much influence on the process of cotton combing as did John William Nasmith. Even Heilmann, the originator of the first cotton combing machine was eclipsed by the life's work of Nasmith. All the great names of the cotton combing world are evoked by his passing: Pinet Lecour, Hetherington, Gegauff, Hübner, Delette, Schlumberger, etc.

The cradle of the best cotton combing machinery was in Alsace from whence J. W. Nasmith was recalled by Messrs. Hetherington to assist in producing the "Delette" comber for the cotton trade in general. In the course of this work he fortunately conceived the idea of combining three rival methods of combing into one machine. The resulting machine was a revolutionary success as it combined great elasticity with increased production and wonderful simplicity. Previously cotton combing had been an expensive operation on account of the meagre productions and the too sensitive mechanisms of the existing combing machines.

The Nasmith comber brought cotton combing within reach of the masses among spinners, whereas it had previously been the privilege of the few who used only long-stapled cottons.

T. ROSS.

### Obituary

The Institute regrets to announce the death of the following member:—

N. KEMP, Galashiels.

### Employment Register

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application.

No. 233—Young man, age 31 years, desires position as Manager in Narrow Fabrics or Hosiery Manufacture. A.T.I. 10 years' experience in all branches of Narrow Fabrics. Practical experience of mill management in all departments. Exempt from military service.

No. 234—Chemist (39), M.Sc.Tech., F.T.I., desires to take up a position where full use could be made of his wide experience in the practical finishing of cellulosic fibres as well as in fundamental and technical research.

\*See *Journal*, 1931, Vol. 22, *Proceedings*, page 49.



## Science and Industry

The Manchester Chamber of Commerce is holding a series of four lectures in Manchester on "Science and Industry." The Institute holds a number of tickets for these lectures, and if any members wish to attend will they please apply to the Acting General Secretary for the appropriate ticket.

The lectures are as follows, each commencing at 11.30 a.m.

Friday, 3rd March—"Research and Industry: The Need, the Ways and the Means," by Rt. Hon. Lord Riverdale of Sheffield, G.B.E., LL.D.

Thursday, 16th March—"Fundamental Research: Its Practical Importance," by Sir Edward V. Appleton, K.C.B.

Friday, 31st March—"The Application of Research," by Dr. Andrew McCance.

Thursday, 20th April—"Research Workers: Their Education and their place in Industry," by Dr. A. P. M. Fleming.

## NOTICES: INSTITUTE MEETINGS

### IRISH SECTION

Tuesday, 21st March, 1944—Annual General Meeting of the Irish Section in the College of Technology, Belfast, at 5.0 p.m.

Wednesday, 22nd March, 1944—Lecture: "Modern Light Sources and Lighting Practice," by R. O. Ackerley, M.I.E.E., at the College of Technology, Belfast, at 6.30 p.m.

### LANCASHIRE SECTION

Friday, 10th March, 1944—Lecture: "Colour from the Artist's point of view," by L. F. N. Reid, D.A. (Edin.), F.R.S.A. (Salford School of Art), at 1.0 p.m. at the Institute's premises.

Saturday, 25th March, 1944—Annual General Meeting of the Lancashire Section at the Institute's premises, at 2.45 p.m.

### LONDON SECTION

Tuesday, 21st March, 1944—Annual General Meeting of the London Section in the rooms of the Rayon & Silk Assn. (Inc.), 229-231, High Holborn, London, W.C.1, at 5.0 p.m.

### MIDLANDS SECTION

Wednesday, 8th March, 1944—Joint meeting with the Midlands Section of the Society of Dyers and Colourists. Lecture: "The Influence of Knitting on Finishing Processes," by W. A. Dutton, A.T.I., at the College of Art and Technology, The Newark, Leicester, at 6.45 p.m.

Saturday, 18th March, 1944—Annual General Meeting of the Midlands Section at the Mechanics' Institute, Burton Street, Nottingham, at 3.0 p.m.

**YORKSHIRE SECTION**

Thursday, 16th March, 1944—Lecture: "The Protection of Wool against Insects and Micro-Organisms," by J. Barritt, B.Sc. (Wool Industries Research Association) at the Midland Hotel, Bradford, at 6.30 p.m.

Monday, 20th March, 1944—Annual General Meeting of the Yorkshire Section at the Midland Hotel, Bradford, at 6.30 p.m.

# THE JOURNAL OF THE TEXTILE INSTITUTE

Vol. XXXV

MARCH 1944

No. 3

## PROCEEDINGS

### TEXTILE TERMS AND DEFINITIONS

The Textile Terms and Definitions Committee has approved the following lists of definitions and notes for publication. The terms in the Tentative List will be considered again after a period of two months, and in the light of any relevant comments and criticisms which might be received. After a more lengthy period terms in the Recommended List will be reconsidered before the definitions in their final form are adopted. Readers are invited to send comments on any of the definitions and notes, or to submit for consideration textile terms which in their opinion require clarification. Communications should be addressed to the Acting General Secretary.

#### TENTATIVE LIST No. 4 (March, 1944)

**Bleaching.** *n.*

The procedure, other than by scouring only, of improving the whiteness of textile material, by decolourizing it from the grey state, with or without the removal of natural colouring matter and/or extraneous substances.

**Combing.** *n.*

Straightening and parallelising fibres and removing short fibres and impurities by using a comb or combs.

**Condenser-spun.** *adj.*

Descriptive of yarn spun from sliver which has been consolidated from strips of card web by rubbing.

Note.—The definition "condenser-spun" includes "woollen-spun" and the term "condenser-spun" is preferred.

**Mungo.** *n.*

The fibrous material made in the woollen trade by pulling down new or old hard woven or milled cloth or felt in rag form.

**Noil.** *n.*

The short fibres rejected in combing.

**Recomber's Noil.** *n.*

The short fibres rejected when recombing tops.

**Shoddy.** *n.*

The fibrous material made in the woollen trade by pulling down new or old knitted or loosely woven fabrics in rag form.

**Sliver.** *n.*

An assemblage of fibres in rope form without twist.

**Top. n.**

A sliver in which the fibres have been parallelised and, usually, combed.

**Wool. adj.**

Appertaining to wool.

**Woollen. adj.**

Descriptive of yarns, or fabrics or garments made from yarns, which have been produced on the condenser system and which contain wool fibre, new or otherwise, in some agreed proportion.

Note 1.—As an adjective appertaining to wool generally the term “wool,” and not “woollen,” should be used.

Note 2.—The trade term “woollen-spun” is descriptive of any yarn carded, condensed and spun on woollen machinery. As such yarn might not contain any wool, it is preferable, therefore, to avoid the use of the term where possible. The term “condenser spun” is recommended instead.

## RECOMMENDED LIST No. 3 (March, 1944)

**Bast Fibre. n.**

Fibre obtained from the inner bark of various plants.

**Chase. n.**

The conical part of the body of yarn in cop, bobbin or pirn form on which the thread is coiled during one traverse.

**Count of Yarn.** The use of “s” in statement of count.

In printing or writing down the count of a yarn it is recommended that where the final “s” is normally sounded the “s” should be given as a small letter immediately following the number indicating the count, without any intervening space or apostrophe and without using a full stop after the “s”, e.g. 40s/2 which would be spoken of as forties two-ply.

**Draw (Mule). n.**

The cycle of operations from the start of the outward run to the finish of the inward run of the carriage of a spinning or a twiner mule.

**Fibre. n.**

A unit of matter characterised by flexibility, fineness and high ratio of length to thickness.

**Fibre ultimate** (ultimate fibre). *n.*

One of the unit botanical cells into which leaf and bast fibres can be disintegrated.

**Filament. n.**

A fibre of indefinite length.

**Rayon. adj. or n.**

A generic term applied to all fibres for textile use which are not of natural occurrence.

*Recommendations for use of term “Rayon.”* It is recommended that “Rayon” be used mainly as an adjective with a noun expressed or understood: *r. staple fibre*, *r. material*, *r. yarn*, etc. It is recommended that a second descriptive adjective be normally used: viscose rayon, soya rayon, etc. There is no objection to any further descriptive adjective, including a maker’s description or name, e.g. Celanese acetate rayon, Fibro viscose rayon staple, etc. Where the context makes it clear, there is no objection to dropping an implied adjective and noun and referring more briefly to viscose, acetate, nylon, etc. It is considered usually desirable that the class should be known.

*Note.*—The Committee considered a number of letters, statements and reviews of the history of terms applied to rayon (as defined above), the docu-

ments totalling many thousands of words. The views expressed were of value in giving a broad picture, and it is believed that all relevant points were considered.

The Committee concluded that a wide generic term was desirable.

In its strict dictionary meaning there is no objection to "artificial" as an adjective for generic application to general terms such as fibre, material, yarn, etc. However, there were objections to modern connotations of "artificial" (e.g. as a poor substitute), to its colloquial abbreviation to "art" and to such applications as *a. silk*, *a. cotton*, *a. wool*, etc. In the absence of a generic term applicable to materials or fibres not of natural occurrence there is a probability that the adjective "artificial" would be retained or re-adopted in general textile and public use. On the balance of the contentions the Committee decided to recommend to textile technologists the term "rayon" as the generic term.

An alternative considered, was the term "synthetic" applied to fibres, materials, etc., in which there has been the production of rayon of higher-weight polymers by chemical process as distinct from the use of polymers provided by natural growth. It was felt that the term "synthetic" should be avoided as a class name of such textile fibres, and also that they, or a further sub-division, should not be described or classed as "mineral" fibres by reason that their manufacture starts entirely from inorganic monomer molecules. There is not, however, objection to the use of such terms as polyamide, polyvinyl, etc., or cellulose or cellulosic or protein or alginate, etc. (*rayon fibres*, etc.) when accurately descriptive.

The different classes of natural and rayon fibrous materials possess widely different chemical and physical properties which may also be modified and varied in any one class. The use of the above term "rayon" does not imply similarity of properties; it is appreciated that different types of rayon differ considerably in suitability for particular applications and a descriptive term indicating the type of rayon, should therefore be employed.

#### Textile Fabric. *n.*

A laminar structure composed of interlacing thread.

## Review

**Elastic and Creep Properties of Filamentous Materials and Other High Polymers.** By Herbert Leaderman, Sc.D. (The Textile Foundation, Washington, D.C.).

The failure to give due consideration to the time factor in determinations of the physical properties of textile materials has undoubtedly minimised the value of many of the results obtained in the past by workers in this field of investigation, but in recent years it has become increasingly apparent that as Dr. H. de Witt Smith points out in his foreword to this volume, "Time is a dimension to be reckoned with in the study of the physical properties of matter, especially the kinds of matter of which good textile fibres and plastics are composed". Abundant confirmation of this statement is provided in Dr. Leaderman's publication which deals almost exclusively with the effect of time on the behaviour of textile fibres and other polymers under load, and there can be little doubt that this book will prove of considerable value to the many investigators who will be engaged in the study of the fundamental physical properties of textile fibres in the post-war period, when the full effects of the ever increasing attention which is now being given to the study of high polymers are brought to bear on the textile industries by the introduction of new types of fibrous materials and new methods of processing.

Dr. Leaderman's publication is a reproduction (with some additions) of a thesis previously submitted by the author to the Massachusetts Institute of Technology, and in style and arrangement follows the conventional form of a thesis.

Part I deals in a clear and logical manner with the historical and theoretical aspects of the study of the phenomenon of delayed elasticity (or "primary creep") and the relationship of this phenomenon to the structure of high polymers. In Chapter I the experiments of Weber, Kohlrausch and others on the "creep" properties of silk and glass filaments, silver wires and rubber threads are described, and the various theories which have been advanced to explain the observed phenomena are discussed. The superposition principle of Boltzmann and the mathematical expression of this principle are dealt with in considerable detail. Chapter II describes a number of mechanical models, and their behaviour on the application and removal of load is compared with the known behaviour of high polymers. Chapter III, which concludes Part I of this volume, gives a historical survey of the various theories which have been proposed of the structure of high polymers. This first part of Dr. Leaderman's book is illustrated by a large number of excellent diagrams.

Part II gives an account of an experimental investigation carried out by Dr. Leaderman himself on the elastic and creep properties of a number of textile materials. The apparatus used and the experimental procedure adopted in the experiments are fully described in Chapter IV, and in the final three chapters details are given of the results obtained on silk, viscose, acetate and nylon filaments. All the experiments on silk and viscose were made under standard conditions of temperature and humidity, but in the case of the acetate filaments the effect of variations in temperature was studied, and in the case of nylon the effects of variations in both temperature and humidity were examined.

In dealing with the record of his own investigations Dr. Leaderman does not present his material in as logical a manner, nor does he interpret the significance of the results as clearly, as he does when dealing with the work of others. In this connection it would surely have been preferable to express all the values of observed deformations under load as a percentage of the original length of the filaments instead of in inches, particularly as the original length of filament used was not the same in all experiments.

The bibliography, which covers the period 1835-1942, contains 210 references arranged in order of year of publication, the authors' names being arranged alphabetically for each year, and a very full index is provided.

Some strain is imposed during prolonged study of this book owing to the fact that it is printed in reproduction typescript.

J. TANKARD.

## Institute Membership

The following applicants were elected to membership at the February meeting of Council:—

### *Ordinary.*

J. U. Ahmed, I.S.D., War Department, 115-A Himayatnagar, Hyderabad Deccan, India (Assistant Inspecting Officer).

Alfred Mellor Buxton, Remenham, Wilmslow, Cheshire (Governing Director, Waterside Mill Co. (Bury) Ltd., Wellington Mill, Bury).

Dattatraya Moreshwar Chogle, I.S.D., War Department, Sholapur, India (Assistant Inspecting Officer).

Nathubhai Lalbhai Desai, c/o Jam Mills Ltd., Sholapur, India (Assistant Weaving Master).

Sisirbindu Dutta, B.Sc. (Cal), B.Sc. Tech. (Bombay), The Laxmi and Visnu Mills, Sholapur, India (Dyeing Superintendent).

Edward B. Higgins, A.M.C.T., 82, Croomhall Road, Higher Blackley, Manchester 9 (Laboratory Chemist, I.C.I. (Dyestuffs Division) Ltd., Hexagon House, Manchester 9).

- Irvin Marsden, 13, Outwood Avenue, Horsforth, Leeds (Textile Engineer, Platt Bros. & Co. Ltd., Hartford Works, Oldham).
- Cyril Maude, A.M.C.T., 23, Roundhill Street, Little Horton, Bradford, Yorks. (Assistant Manager, Sterling Silks Ltd., Millholme Shed, Nr. Skipton).
- Feather Bruce Murgatroyd, 1, Vernon Street, Cross Road, Keighley, Yorks. (Military Service).
- Gerald Park, 105, Lynwood Avenue, Darwen, Lancs. (Designer and Assistant Manager, J. & L. Ward Ltd., Unity Mill, Lower Darwen, Lancs.).
- Arnold Mason Price, 67, Calderbrook Road, Littleborough, Lancs. (Head Warehouseman, Roger Shackleton & Son, Ltd., Mitchell Hey Mills, Rochdale).
- V. G. Rajah, Janardana Mills Ltd., Singanallur P.O., Coimbatore Dt., India (Assistant Manager).
- Reginald John Roberts, M.Sc., c/o Messrs. Hawley & Johnson Ltd., North Bridge Works, Leicester ((Technological Dyer).
- A. K. Simcox, B.Sc., 81, Ducie Grove, Whitworth Park, Manchester (Technical Assistant, I.C.I. (Dyestuffs Division) Ltd., Hexagon House, Manchester 9).
- Charles R. Smith, 15, Mabfield Road, Fallowfield, Manchester 14 (Weaving Manager, Thos. French & Sons, Ltd., Sharston Road Factory, Wythenshawe).
- Jan Walasik, A.M.C.T., 8, Egerton Road, Fallowfield, Manchester 14 (Student, Manchester College of Technology).

#### *Junior.*

- Alan Berton, 4, Wilmslow Road, Didsbury, Manchester (Laboratory Assistant and Student, Bleachers' Association Ltd., Parsonage, Manchester).
- Basil Carmont Ellis, 855, Kingsway, East Didsbury, Manchester 20 (Laboratory Assistant, Manchester Chamber of Commerce Testing House, King Street, Manchester).

#### **Correction**

See page P27.—The place of employment of J. H. Chapman should read Messrs. Quortex Ltd., Mansfield.

## General Items

### **Employment Register**

The following announcement is taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application.

- No. 235—Member, holding Diploma in Dyeing, with practical experience in chemistry and dyeing, desires position with dyestuffs and chemical manufacturers with view to later position in connection with technical sales and services abroad.

### **Vacancies**

Large Textile Manufacturing Company requests applications for the following two vacancies:

**ASSISTANT PRODUCTION AND PLANNING CONTROL ENGINEER.**—Should have good general and technical education, together with knowledge and experience of modern methods of factory control and organisation; textile background desirable, but not a necessity. Position will be permanent with appropriate salary.

**TEXTILE CHEMIST.**—Should be fully trained and holding appropriate scientific qualifications. Duties will include the operation of a large textile laboratory for routine laboratory methods with additional work on research in collaboration with textile research association. Position will be permanent with suitable salary.

Applications, giving full particulars, should be addressed to Box No. 66.

**NOTICES: INSTITUTE MEETINGS**

Wednesday, 19th April—*Manchester*. 11-4.5 a.m. Annual General Meeting of the Institute at the Midland Hotel, Manchester.

Wednesday, 19th April—*Manchester*. 2-30 p.m. Mather Lecture: "Educational Reconstruction with some special reference to the Textile Industries," by Professor G. D. H. Cole, at the Midland Hotel, Manchester.

Friday, 21st April—*Manchester*. Preliminary Examination for the Institute's Associateship Diploma.

**LANCASHIRE SECTION**

Friday, 14th April—*Manchester*. 1-0 p.m. Lunch-time meeting at the Institute's premises. Subject to be announced later.

Saturday, 29th April—*Manchester*. 10-0 a.m. Lancashire Section visit to Imperial Chemical Industries Ltd., Dyehouse Department, Blackley, Manchester 9.



# THE JOURNAL OF THE TEXTILE INSTITUTE

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## PROCEEDINGS

### ANNUAL GENERAL MEETING, 1944

There was a large and enthusiastic attendance of members at the Annual General Meeting, followed by a luncheon and the Mather Lecture in Manchester on 19th April.

After the notice convening the meeting had been read, and the minutes of the previous meeting approved, the Council's Report for 1943 as circulated was put before the meeting and unanimously accepted. The Auditors' Report was then read and the Revenue Account and Balance Sheet for 1943 were approved and adopted.

At this point Mr. H. L. Johnson, the retiring President, addressed the meeting. He said that he had derived much pleasure from his office during the past two years, and he expressed his sincere thanks to the Council, Honorary Officials and staff for the great support which they had given him. Mr. Johnson then proposed that Mr. T. H. McLaren, who had been nominated by Council, be elected as President of the Institute, for the coming year. The proposal was ably seconded by Dr. A. W. Stevenson and Mr. McLaren was unanimously elected. He was then invested with the badge of office and took over the chair from the retiring President. In his reply Mr. McLaren expressed his sensibility of the honour which had been conferred upon him, and hoped that he could live up to the high standards which had been set by previous holders of the office. On behalf of the Council and members he warmly thanked Mr. Johnson for all that he had done for the Institute during his term as President. Mr. McLaren's reply follows this report.

Three Vice-Presidents were elected for a period of three years, the members elected being:

Mr. F. W. Barwick of Manchester, Mr. F. Kendall of Shipley, and  
Dr. J. C. Withers of Manchester.

The result of the ballot for election to Council was then read to the meeting and the Chairman declared the following members elected:

For a period of three years:

A. W. Bayes (Hyde)  
C. H. Colton (Manchester)  
H. G. Greg (Stockport)  
F. Pickles (Leeds)  
E. J. Poole (Bradford)

R. J. Smith (Manchester)  
J. B. Speakman (Leeds)  
A. J. Turner (Belfast)  
H. A. Turton (Nuneaton)  
F. C. Wood (Manchester)

For two years: R. Lord (Manchester).

For one year: T. Ashurst (Manchester).

Messrs. A. E. Piggott, Son & Co., incorporated accountants, were re-elected as auditors of the Institute for a further year.

The Chairman declared the business meeting closed, and members retired for lunch, when four guests were entertained: Mr. G. D. H. Cole, Mr. T. Boyd, Mr. H. S. Butterworth and Mr. E. Mercer. After the toast of "The King," Mr. H. L. Johnson proposed the toast of "Our President," and Mr. H. G. Greg the toast of "Our Guests." Mr. T. Boyd, immediate past Chairman of the British Launderers Research Association, replied on behalf of the guests, and while so doing expressed a hope for additional co-operation between the textile manufacturer and the launderer. His points were well stressed by two stories from his native land of Scotland.

After the luncheon Mr. G. D. H. Cole, the well-known economist, gave the Mather Lecture, his subject being "Educational Reconstruction with some special reference to the Textile Industries." The full lecture is given on pp. p51-p60 of this *Journal*.

**PRESIDENT, 1944**

At the Annual General Meeting in Manchester on Wednesday, 19th April, Mr. T. H. McLaren, of Dundee, was elected as President of the Institute for the ensuing year.

Mr. McLaren comes from an old Fifeshire family which has been associated with textiles for generations. After leaving Dollar Academy he joined his father in the linen and cotton manufacturing firm of Thomas McLaren & Son, where he had a thorough training in the managerial, financial and practical sides of the textile industry.



**T. H. McLAREN**

**PRESIDENT, 1944-1945**

During the last war he served in the Royal Artillery. He joined his own battery on its formation, and commanded it with the rank of Major in both France and Italy.

After the war years he returned to the textile industry and in 1927 he became managing director of Baxter Bros. & Co. Ltd., one of the largest flax and hemp spinning, weaving, bleaching, dyeing and finishing concerns in the country. This position he retained until the outbreak of the present war when he undertook the office of Deputy Flax Controller, which office he still fills.

**PRESIDENTIAL ADDRESS**

Ladies and Gentlemen,—You have elected me to be your President for the ensuing year and I accept office.

In doing so I wish to thank the retiring President and his seconder for the kind words he has used and for the manner in which you have responded. I am very conscious of the honour which you have conferred upon me, more especially as I am the first representative of the flax industry to occupy this important position. It will be my constant aim during my term of office to do all I possibly can to further the interests of the Institute in all directions and, if desired, to visit district sections from time to time.

Despite the difficulties of the present time, membership of the Institute continues to expand—the pace of expansion has accelerated under Mr. Johnson's Presidency and I am hopeful that the yearly increase will not shrink during 1944/45.

There is much to commend membership of the Institute to all far seeing and energetic firms and individuals in the textile industry. It is always difficult to arouse the interest of the unconverted and it inevitably rests largely upon you members to take every opportunity of bringing to the notice of your friends and neighbours the benefits which the Institute offers, and the activities which it pursues for the benefit of the industry in general.

What are its activities? I will remind you of some and I am sure you will agree that it should be more widely supported, especially if you consider this in connection with post-war problems—which we all do in moments of relaxation from the arduous essential war-time duties imposed upon us.

First, the Institute brings together all branches of the textile industry. In these enlightened days we cannot hope to be successful in our particular textile if we do not give some heed to developments taking place in what may well be competing branches of the industry. The Institute is neutral ground on which we meet, discuss and plan—the more we meet and know each other the better for all concerned. These are the occasions when petty jealousies are driven away, friendships formed and mutual aid freely offered and taken.

Secondly, I should like to mention the attitude of industry to research. Our individual industries have research associations which are supported by Government grants and by contributions from firms in the industry. The days of industries running along on their own volition by the skill and impetus derived from previous generations no longer exist. Modern conditions demand the application of science at all stages of production—progressive firms recognise this and an increasing number employ research staffs who work closely with the research establishments supported by the industry. Many firms, who are members of research organisations, but who do not employ research technologists, cannot possibly benefit to the same extent as the firms who have this scientific assistance. We all know that the research scientist couches his papers and solutions to problems in language which is very often beyond the ordinary business man, and it follows that the firm with a scientifically trained research technologist can have these papers readily interpreted and thus utilise the findings if suitable to their particular business.

To those who have no scientific assistance the Textile Institute provides the link between research and industry. The *Journal* published each month contains scientific papers and abstracts of publications from all over the world. These abstracts are understandable by the ordinary man and, therefore, all members are enabled, through its medium, to take a lively interest in and appreciate what is going on in the world of textiles. At the same time the Abstracts Section of the *Journal* is of great service to the research technologist and scientist saving him much time and providing a comprehensive reference to textile developments. The Transactions papers place before him original work of a high order.

Thirdly, there is the question of standardisation, which gains in importance as the years pass. In pre-war days the Institute was very active in this sphere—war conditions interrupted the normal programme of this important function, but emergency work has been undertaken. Standardisation is an activity which must be kept well to the fore and negotiations are proceeding at present with the British Standards Institution which I hope will be concluded shortly on lines satisfactory to all parties concerned.

My fourth point is on education and training. Unhappily, the ravages of war have removed from our midst many promising executives, managers and foremen. Furthermore, recruitment has of necessity been at a low level and there will be a shortage of these essential types of employees unless strenuous efforts are made. If our industries are to be efficient again it is vital to employ the most highly trained personnel it is possible to find. To-day, the old-fashioned system of engaging a likely lad and supervising his training in our mills and factories is not good enough.

The prospects of an attractive career in textiles must be made known to students in our Secondary Schools and Universities, and this the Textile

Institute does in large measure. Satisfactory arrangements have been made whereby Universities and Technical Colleges throughout the country co-operate closely with the Institute. Courses of study are so arranged that on a certain standard of knowledge being attained the student qualifies for the Institute's diploma, either as an Associate or as a Fellow of the Textile Institute. The possession of a diploma guarantees to the prospective employer that the candidate has attained a definite standard of knowledge of textiles and has held a position of responsibility within the industry for a minimum period. Thus the diploma is in itself a recommendation to an employer requiring the services of highly trained personnel.

Employers are coming more and more to recognise the value of these diplomas as the guarantee of attainment and of skill as a textile technologist. To those who are not yet fully acquainted with the standing of these qualifications I would say, "Look at them carefully," for the diplomas ensure the flow of the right type of personnel to the industry. They save the industrialist much valuable time when considering applications to fill important posts in their organisations.

The importance of this sphere of the Institute's activities cannot be overstressed, and each member should make himself acquainted with the various schemes and scholarships in existence so that he may guide young men presently employed by him or students who may appeal to him for assistance.

Modern industry is team work highly specialised and the Institute Diploma the hall mark of knowledge and skill. By its educational schemes, its competitions for textile design, its accumulation and dissemination of knowledge, and its encouragement to all those interested in textiles, the Institute is furthering the productive power of the Textile Industry; and by producing a flow of suitably qualified textile technologists it ensures the continuity of this productive power at a high level.

The tempo of affairs increases, post-war export markets will be fiercely contested—it remains for the industrialists to take full advantage of what is offered and so regain and maintain the world-wide reputation for textiles of the highest quality.

You all know I hope how membership of the Institute will assist. It must be supported by all interested in textiles, owners and directors must be encouraged to give time to their executives to assist the Council in their deliberations.

To sum up, therefore, we have, through the medium of the Institute:

- (a) The opportunity of contact, one branch of the Industry with another.
- (b) Contact with research workers.
- (c) Control of standardisation.

Lastly, but tremendously important, guidance can be given in the education, training and the granting of the Institute's Diplomas which guarantee a standard of knowledge and skill of entrants to industry.

I could talk much longer on the points I have made, but that would simply bore you—I have tried to be concise and fervently trust my remarks are not misunderstood.

In conclusion, I should like, on your behalf, to thank the retiring President, Mr. Johnson, for the very great help he has given the Institute during his two years of office. The knowledge of his energy and drive has been an inspiration to all, and we are very much indebted to him for the services he has rendered.

## COUNCIL'S ANNUAL REPORT, BALANCE SHEET AND ACCOUNTS FOR 1943

*Presented to the Annual General Meeting at Manchester, Wednesday, 19th April, 1944.*

The Council has much pleasure in presenting the following Report, Balance Sheet and Accounts for the year ending 31st December, 1943.

### **Balance Sheet and Accounts**

The financial position of the Institute has been further consolidated during the year, all accounts showing a healthy state. An increase in membership has resulted in an addition to the total of subscriptions received. Under present conditions the general situation is quite satisfactory.

### **Annual Meeting**

A large number of members were present at the Annual Meeting in Manchester to take advantage of the opportunity to meet together. Such opportunities are few at present but the interest is still maintained and augurs well for the future. Mr. H. L. Johnson was re-elected as President, and presided at the luncheon which followed the meeting.

### **Mather Lecture**

Sir Robert H. Pickard delivered the Mather Lecture, his subject being "Textile Research and Development." The lecture was held in conjunction with the Annual Meeting.

### **Institute Honours**

During the year the Service Medal was awarded to Mr. T. A. Purt, in recognition of his valuable services to the Institute over a long period, as Honorary Secretary of the Midlands Section.

### **Publications Committee and the "Journal"**

Reductions in the supplies of paper restricted the size of the Journal, but a number of changes were made in order to alleviate the position. The chief alteration was the substitution of a lighter weight paper so that more pages could be included in each edition. In spite of these difficulties the three sections of Proceedings, Transactions and Abstracts have been maintained.

The policy of giving full reports of most Section meetings has been continued. Although in the early part of the year there was a shortage of papers for the Transactions the position improved later. It is hoped that the improvement will continue, as it is an essential part of industrial progress that there should be as much publication as possible of textile investigations. The number of Abstracts is still limited by the decrease in the number of foreign journals received.

The Committee again records its appreciation of the services of Dr. F. C. Wood, Honorary Editor of the Proceedings Section, and of others, particularly the staffs of research associations.

### **Diplomas Committee and Institute Diplomas**

The Institute's Examinations for the Associateship Diplomas were held as usual in 1943. The Preliminary Examination was held on 24th March, 1943 and the Examination in General Textile Technology was held on 26th May at Belfast, Glasgow, Manchester and Nottingham. In the Preliminary Examination there was one successful candidate from a total of twelve. In the Examination in General Textile Technology, 10 candidates were successful out of a total of 17.

Applications for the Institute's Diplomas during 1943 totalled 53 (12 Fellowship and 41 Associateship), as against 45 in the previous year (12 Fellowship and 33 Associateship). During the year 8 Fellowship and 16 Associateship Diplomas were awarded. The total number of applications since the Charter was granted in 1925, reached 1,370 (395 Fellowship and 975 Associateship) of which 299 for the Fellowship and 632 for the Associateship were successful.

### **National Certificates in Textiles**

In 1943 there were 44 (61) candidates for the Ordinary and Higher Certificates, 36 (55) Certificates being awarded, 1 (3) with Distinction; (the figures in brackets are for 1942). Seventy-one courses are now recognised at 27 Colleges and Schools.

### **Textiles and Designs Committee: Institute Competitions**

The Committee, realising that the time which students can devote to preparing entries is strictly limited, instituted a War-time Competition in place of the former Crompton Competition. There was a gratifying response and some of the patterns were of a high standard. Sections were also held for worsted cloths, and for printed designs. The latter competition attracts more candidates each year, especially from the art schools. It is felt that the interest maintained in the competitions is quite satisfactory during present conditions, and that a beneficial stimulation is given to textile design by this section of the Institute's work. The total number of entries in 1943 was 69 as compared with 87 in the previous year.

The Committee prepared its 24th Reference Collection Album of fabrics which is used to give students a direct contact with modern trends in design and structure. Assistance was also given with the adjudication of entries to the two textile design competitions organised by the Education Department of the Lancashire County Council.

### **Library**

The Library facilities are used by many members, but there are still those who do not appreciate that they can borrow publications either by calling at the Institute or through the post. The loan of current trade and professional journals, in conjunction with the Abstracts Sections of the Journal, is much appreciated by those members who take advantage of the opportunities available. The creation of a film library is under consideration.

### **Scholarships**

No scholarship awards were made, although a grant for research work was allowed to a member. The Council, however, has started an enquiry into the funds and awards which are available for textile scholarships and it is anticipated that useful information will be available in the future.

### **Industrial Recruitment and Development Committee**

This Committee was newly constituted during the year by merging the Industrial Development Committee and the Committee for Recruitment, Selection and Training for the Textile Industry. It continued to investigate the various problems related to recruitment for and development of the textile industry and is acquiring some useful information which should be of service to the industry, in due course. During the year the Cotton Board set up a Recruitment and Training Department, and the Institute has three representatives on the Advisory Committee for this department.

### **Textile Terms and Definitions Committee**

Further publications of terms were made in the Journal and comments both for and against the committee's decisions were received. This can be taken as certain evidence that the work undertaken is necessary and that it is making some progress. Any standardisation of terms is bound to cut across some of the previously accepted but ambiguous usages, and although the work is relatively slow and certainly difficult, the Committee hopes to make a valuable contribution to the textile industry.

### **Standardisation in Textiles**

A reorganisation of the Institute's Scheme for Standardisation is taking place. Apart from this, however, the Institute has started on the preparation of standard tests for narrow fabrics on behalf of the Narrow Fabrics Directorate of the Ministry of Supply. In addition papers are still being prepared on strength testing, and also in connection with the Bundesmann Test for Water Repellency.

### **Council and Committee Meetings**

The following is a record of meetings held during 1943:—Council, 9; Finance and General Purposes, 11; Publications, 12; Diplomas, 11; Joint Committee re National Certificates, 2; Textiles and Designs, 1; Unification of Testing Methods, 2; Industrial Recruitment and Development, 7; Textile Terms and Definitions, 10; Library, 1; Lancashire Section, 3; London Section, 1; Midlands Section, 2; Yorkshire Section, 3; In addition 7 sub-committees met on 17 occasions for the consideration of special matters.

The total number of meetings for 1943 was 92 as against 98 in the previous year.

### **Section Activities**

Some of the most successful lectures and discussions since the commencement of the war were held by Sections during the past year. The following functions give a healthy picture of Section activities. Irish Section, five lectures, two visits; Lancashire Section, fifteen meetings; London Section, three meetings; Midlands Section, five meetings; Scottish Section, three meetings; Yorkshire Section, four meetings and one visit.

### **Membership**

The membership list at the end of 1943—to be carried forward to 1944—was made up as follows:—Honorary Life Members, 15; Life Members, 63; Ordinary Members, 1,664; Junior Members, 98; total 1,840 as against 1,764 at the end of 1942. Of the numbers at 31st December last, 213 had been admitted to the Fellowship and 488 to the Associateship.

The Institute suffered a particularly heavy loss through the deaths of J. H. Lester, who was a Vice-President and one of the hardest workers in the foundation of the Institute; J. W. Nasmith, an Honorary Fellow; and F. C. Porter, a Vice-President.

The Council regrets to announce the loss by death, during 1943, of the following members:—J. S. Addison (Baintree), C. Barker (Manchester), J. W. Baron (Blackburn), A. L. Forster (Glasgow), A. E. Hall (Davenport), R. Geigy (Basle), J. S. Hall (Totnes), J. M. Hey (Manchester), A. H. Holden (St. Annes-on-Sea), N. Kemp (Glasgahills), Sir James Morton (Carlisle), D. O. Moss (Morley), R. E. Oldroyd (Rochdale), C. Padgett, (Bradford), A. Preston (Nelson), W. H. Ross (Leeds), Sir Michael Sadler (Oxford), E. Salt (Leek), J. C. Williams (Manchester).

15th March, 1944.

Dr. Cr.  
**The Textile Institute—Balance Sheet as on 31st December, 1943**

LIABILITIES			ASSETS			
1942 £	s.	d.	1942 £	s.	d.	
Foundation Fund—			Furniture, Fittings and Library Account—			
10935	1	4	...	28	10	7
5500	0	0	General Account	...	...	...
3500	0	0	Cotton Reconstruction Board Grant	11513	0	9
1039	15	3	Crompton & Beauland Fund	...	...	...
—	—	—	Life Membership Reserve Account	5502	13	3
1000	0	0	Life Membership Subscriptions	3515	1	0
—	—	—	Life Membership Reserve Account	...	...	...
—	—	—	Frank Wright Memorial Fund	752	10	0
—	—	—	Research Studentships Account	1000	0	0
—	—	—	Scholarship Scheme Reserve Account—	...	...	...
1034	2	1	Balance as on 31st December, 1942	45	16	4
88	4	10	Add Surplus Income for year	243	7	0
109	0	6	Crompton and Beauland Prize Fund Scheme Reserve—	148	15	5
89	1	4	Account—	...	...	...
80	2	7	Balance as on 31st December, 1942	162	14	10
819	6	6	Add Surplus Income for year	9	15	6
1314	9	0	National Certificates Scheme—	99	11	3
£25609	3	5	Balance as on 31st December, 1942	9	10	0
£26734	17	8	Add Surplus Income for year	...	...	...
£26734	17	8	Frank Wright Memorial Fund Reserve Account—	...	...	...
£26734	17	8	Balance as on 31st December, 1942	1283	6	8
£26734	17	8	Add Interest on War Stock	905	4	2
£26734	17	8	Subscriptions paid in advance	...	...	...
£26734	17	8	Sundry Creditors and Reserves	...	...	...
£26734	17	8	Revenue Account—	...	...	...
£26734	17	8	Balance as on 31st December, 1942	...	...	...
£26734	17	8	Less Transfer to Foundation Fund	...	...	...
£26734	17	8	Add Surplus Income over Expenditure for year 1943	267	10	1
£26734	17	8	£25609	3	5	
£26734	17	8	£26734	17	8	

**AUDITORS' REPORT TO THE MEMBERS.**

We report to the members that we have examined the above Balance Sheet, together with the books and vouchers of the Institute, and that we have obtained all the information and explanations we have required. We further report that in our opinion the Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Institute's affairs according to the best of our information and the explanations given to us, and as shown by the books of the Institute.

70 Spring Gardens, Manchester, 2.  
 22nd March, 1944.

Signad H. JAQUES, *Chairman of Finance and General Purposes Committee.*

ARTHUR E. PIGGOTT, SON & CO.,  
*Incorporated Accountants, Auditors.*

Dr. **The Textile Institute—Revenue Account for the Year ended 31st December, 1943.** Cr.

EXPENDITURE		INCOME	
£ s. d.	£ s. d.	£ s. d.	£ s. d.
42			
181 5 0	To Rent and Rates ...	2880 17 0	By Membership Subscriptions (1943) ...
	Less to Journal Account ...	66 8 11	„ Paid in advance in 1942 ...
88 5 3	„ Heating, Lighting and Cleaning ...	174 3 1	„ Arrears paid ...
	Less to Journal Account ...		„ Transfer from Life Membership Subscription Account
193 11 0	„ Salaries ...	21 0 0	„ Special Subscription—The Weavers Co. ...
	Less to Journal Account ...	15 18 11	„ Interest on Life Membership Investments ...
409 11 9	„ Wages ...	29 11 0	„ Interest on Diploma Investments ...
	Less to Journal Account ...	133 7 7	„ Diploma Fees ...
46 13 7	„ Pension Fund Contributions ...	3221 6 6	„ Less Amount transferred to Journal Account ...
36 15 0	„ Savings Association Contributions ...	794 5 2	
154 15 6	„ General Expenses ...	2527 1 4	„ National Certificates, Competitions, and Standardisation—Administration Expenses ...
140 19 1	„ General Printing and Stationery ...	65 0 0	„ Bank Interest Less charges ...
93 14 7	„ Postages, Telegrams and Telephone ...		„ Foundation Fund Income from Investments ...
41 7 0	„ Insurances ...	13 0 6	„ Editorial Board ...
56 11 0	„ Audit and Legal Expenses ...	360 13 10	
3 3 0	„ Subscriptions to Institutions ...	2 13 1	
421 0 0	„ Income Tax ...		
90 0 2	„ Section Expenses ...		
12 18 6	„ Annual Conference Expenses ...		
39 9 3	„ Meetings and Travelling Expenses ...		
26 0 7	„ Library Account ...		
	„ Editorial Board ...		
5 19 5	„ Recruitment Committee ...		
72 2 3	„ Diplomas Account Expenses ...		
	„ Medal Account ...		
58 11 7	„ A.R.P. Expenses ...		
100 0 0	„ Grant to Standardisation Account ...		
75 0 0	„ Education Grant ...		
2347 13 6			
620 15 3	„ Surplus Income over Expenditure for year ...		
£2968 8 9		£2968 8 9	
			£3989 8 6

NOTE.—The Market Value of Securities as on 31st December, 1943, was approximately £23,421 1s. 8d. In order to save paper the following have not been printed, but copies may be seen at the Institute: the Schedule of Investments and the Journal, Foundation Fund, Competitions, Scholarship and Frank Wrigat Memorial Fund Accounts. The Institute has entered into a new arrangement for the assessment of Life Membership subscriptions for tax purposes. This has necessitated the transfer of old balances from Life Membership Accounts to Foundation Fund Accounts.



## THE MATHER LECTURE\*

### EDUCATIONAL RECONSTRUCTION WITH SOME SPECIAL REFERENCE TO THE TEXTILE INDUSTRIES

By G. D. H. COLE

Let me make it clear at the outset that any claim I have to speak on this subject is that of a teacher and of a student of Economics, and not that of a textile expert. I have no special knowledge of the textile industries—no know-at all beyond what an economist with a bias towards the study of industry may be expected to pick up as part of his general equipment. It is therefore primarily of education generally, rather than of any education peculiarly appropriate to the textile trades, that I propose to speak; and it is natural to begin with the Education Bill which has recently been passing through its prolonged committee stage in the House of Commons.

Under the Bill it is proposed, at a date which still unhappily remains unsettled, to raise the school-leaving age to 16; and well before that is done, it is intended to introduce a universal system of secondary education up to the age of 15. These changes are to be brought about at a period when the number of juvenile entrants to employment will be in any case falling off, owing to the decline in the birth-rate; and they will evidently confront manufacturers in many industries with considerable problems of readjustment in the labour force. Moreover, it is proposed to introduce as soon as possible a system of day-time release for work in Young People's Colleges between the ages of 15 and 18—beginning with one day a week, but, it is to be expected, with the intention of advancing gradually to a system of half-time schooling and half-time employment. This will further diminish the juvenile labour supply, and will besides involve a good many complicated problems for the managements of the establishments in which these young people are employed.

Why are these changes being made or contemplated? Is it because we are coming to set a higher value on our young people now that they are getting scarce? Is it because industry demands higher standards of knowledge and trained intelligence from those whom it employs? Is it because we want better educated citizens, rather than better trained workers? Or is it merely that the educationists are persistent people, and have managed to force their ideas upon the rest of us, without our knowing very well whether we really agree with them or not? I can think of four possible reasons for wishing to extend the duration of school life for the mass of the people—that it will make them better, or happier, men and women; that it will make them better workers; that it will make them better citizens; and that, whether it makes them better or not in any respect, it is at any rate worth while to keep them out of "gainful employment" somewhat longer. Three possible positive reasons, and one negative reason; and we may, of course, be moved at once by all four.

Now, how much difference will it make to what we set out to do practically which of these reasons moves us most? Some will answer that, if our primary aim is to make better workers, we shall incline to give any additional education we provide a marked vocational or technical bias. I doubt, however, if this is really so. Not long ago, I had the privilege of presiding over a conference including employers from a good many industries, including textiles, who all seemed to agree that they did not want the schools, even if the age were raised, to teach their pupils to follow a particular trade. They could do that themselves, they said, when the young people came into the factories. What they wanted was that the new entrants to industry should be as lively, as quick-witted, and as adaptable as possible, with a good basis of general knowledge,

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Delivered on the occasion of the Annual General Meeting of the Textile Institute, held in Manchester on 19th April, 1944.

including some mathematics and some elementary science and a power to understand, speak and, if possible, write good plain English. Young persons possessed of these attributes, they said, would be the right material for making into good workers; and I was very glad to hear them say it as if they had no doubt about its truth. For these are precisely the attributes that are likeliest to make the young person an intelligent citizen; and they should also help to make him, or her, a better and a happier person. Thus, if this view is endorsed, our three positive reasons for extending educational opportunities march together, and are not in conflict, as they have often been supposed to be.

Please observe that I said "an intelligent citizen"—not "a good citizen"—and that I qualified my expectation that more of the sort of education I spoke of would make better, or happier, men. An intelligent citizen is not, alas, necessarily a good citizen; nor is a well educated person necessarily better, or happier, than an ignoramus. More education, even of the best sort, may make men bad citizens and bad and unhappy persons if the mental attainments achieved come into sharp conflict with the facts of contemporary life. If mass-unemployment prevails, and there are few opportunities in employment for the use of the higher faculties, the better the quality of our education is, the more discontent and mental disharmony will it provoke. That's how Nazis are bred—out of thwarted capacity for better things and the sense of moral futility which is the psychological counterpart of disorder in economic affairs. Men and women will not be better citizens, or better or happier persons, if we prepare them for higher forms of production and service, and then confront them with a "No Hands Wanted" notice when they ask for the opportunity of putting their capacities to practical use. No educational system will make for greater happiness or goodness or better citizenship unless the community can find good uses for all the capacity which it sends forth from its schools into the labour market. Full employment and educational advance must go together; even if we educate men and women in the art of living, rather than for production, we must see to it that they have the means of living by useful service, or we cannot expect them to live happily, or well.

The entrants to gainful employment divide themselves—and will continue so to do under the system of to-morrow—into four main streams. Some enter unskilled, or relatively unskilled, jobs, as learners—not apprentices—at or near the minimum school-leaving age. Some, then or a little later, enter skilled trades, as apprentices or under some less formal arrangement for graduation into a skilled craft. Some stay on longer at full-time schooling, and enter gainful occupation somewhere between 16 and 19, as clerical or administrative workers, or as premium apprentices, or in some other way rather higher up the hierarchy of jobs. Some go on to a University or to higher full-time technical courses, and become employed only as adults—at 20, or 21, or even 22 or 23. A few protract their education even beyond this point, and become doctors or professional or research workers in some calling which demands an exceptionally long training; but for my present purpose I can group this fifth stream—numerically no more than a trickle—with the fourth.

At present, these four groups are much too sharply distinct—not merely at the moment of entry to "gainful employment" but, in most cases, for life. It is very much harder than it ought to be for a "late developer," or for a boy or girl who has to leave school early and then shows high capacity needing special training, to get the opportunity to develop to the full. The difficulty of moving from one group to another is inconsistent both with democracy and with getting the best out of our people in productive service. It is inconsistent with the aim of sorting people out to the fullest possible extent into the jobs they will do best, and enjoy most. We must not, therefore, be content to regard our four streams of entrants to employment as flowing for ever apart. There must be plenty of channels leading from one stream to another, not simply near the point of entry, but through adult life as well.

As long as we bear this well in mind, we can conveniently discuss the four streams one by one. In future, we are told, every normal boy and girl will have, from eleven to at least fifteen, not less than four years of secondary education. What will this mean in practice? It will mean, first, that boys and girls for whom the literary education of a Grammar School is regarded as the most suitable will not be prevented from getting that type of education—up to fifteen—by the parents' lack of means. But merely to put this point is to reveal a real difficulty. The Grammar Schools are not designed to receive boys and girls who will leave at fifteen. They must keep their pupils at least to sixteen in order to do them justice. This involves the provision of scholarships and maintenance allowances on a generous scale—not merely to keep in the Grammar School for at least a year beyond 15 those who have got to them in the first instance, but to ensure that the right boys and girls do get to them at 11 and are not shut out because of the parents' uncertainty of being able to see them through.

I do not, however, anticipate a very great growth of Grammar School education as a consequence of the new Bill. Indeed, I should be sorry if the main stress were laid on the Grammar Schools. There is much more risk of things going wrong with the two other types of secondary schools which, with the Grammar Schools, will constitute the new provision of secondary education for all. We have at present far too few Junior Technical Schools; and we must clearly plan for an increase in this field. What Junior Technical Schools we have are, I believe, mostly pretty good, and on the whole well-equipped. They are good and well-equipped partly because they are few, and it has been possible to spend money on them without raising cries about extravagance. The great danger now is that a rapid increase in their number may lead to a deterioration in quality. It will not be easy, however hard we try, to staff them really well; for there will be many competitors for the services of really good teachers. Equipment is bound to be expensive; and it is of the greatest importance that it should not be stinted. But equipment, though important, is not the greatest need, which is that the new Junior Technical Schools shall be places in which the pupils will get a real grounding in the knowledge that is vital for the mastery of the modern world and its problems, and not a merely vocational preparation for a particular trade. Basic science and mathematics, rather than trade subjects, are the elements in the curriculum upon which the chief stress must be laid; and with science and mathematics must go a training in the ability to speak, write and appreciate good, clear English and some understanding of the essential institutions of the society into which the pupils will go forth to live and work.

In the world into which we are moving, I believe it will become necessary for most of us to be much more mobile between job and job than in the past. No one, I hold, ought to be so specialised as to be good for nothing but a single trade. I look forward, indeed, to the time when no one will work most of his life continuously at a single type of work; but in relation to school, including the Technical School, what I am urging is that school ought to be a place in which young people learn, not trades, but basic techniques and a basic sense of realities that will make it easy for them to turn their hands to any of a wide variety of jobs. The need of our age is for intelligent adaptable people, who will be ready to turn their hands to this or that in accordance with changing needs and opportunities. We shall want quite a large proportion of our young people to have, as the basis of this adaptability, an understanding of the essentials of modern science and a capacity to use elementary mathematics in a practical way. This is, above all else, the task of the Technical School; and it is right, for this purpose, that to the extent to which it is inclined towards a particular technique, the bias should be in the direction of general engineering—for that is the natural bias for a predominantly mechanical age.

Very much more difficult is the problem that confronts us in the making of what is to be called the "Modern School"; for the easiest, and the worst,

way of thinking of the "Modern School" is to regard it as a "dump" for the boys and girls who are not deemed suitable either for the Grammar School or for the "Junior Tech.". In a sense, no doubt, that is what it must be; for, as every normal child must go to one of the three, it follows that those who go to neither of the others must go to the Modern School, which is therefore bound to have on its roll the less promising children in an intellectual sense. This is unavoidable; but we must on no account allow it to induce us to act as if the Modern School matters least, and can be put off with the worst. The temptation so to behave will be considerable. The Grammar Schools and the Technical Schools will both start with higher prestige in their several ways than the Modern Schools. There will be a tendency for the better teachers to prefer teaching in them, and for Local Education Authorities to pick the better teachers for them. The Modern Schools will be inevitably taking over in the first instance many of the buildings hitherto used as elementary schools and many of the teachers from such schools; and there will be a temptation to regard them as merely elementary schools for the older children under a new-fangled name.

This is what we have to prevent. Do not think I am casting stones at the elementary schools. I am well aware that, particularly in some of the newer Senior Schools, very fine work is being done—the finer for being untrammelled by the examinations which beset the existing secondary schools. I know there are fine Central Schools under the elementary code. But there are also very bad elementary schools and "higher tops" for the older children, and there are areas in which almost the whole of the provision is bad. Moreover, if secondary education for all is really to mean something different from what has existed hitherto, there must be both a great improvement in standards of staffing and accommodation and a large infusion of new blood drawn from teachers whose traditions are those of secondary education. We must mix our teachers up, in order to make the most of the limited supply of really good ones; we must not allow the Modern Schools to be put off with the leavings after the other types have taken what they want.

In order to give the Modern Schools the right start, we must make up our minds as clearly as we can what we want them to do. They will be dealing with the main body of children who enter gainful employment at the school leaving age, and especially with those who do not proceed to an apprenticeship, formal or informal, to a recognised skilled trade. What qualities do we require of them, either as producers or as citizens? That we want them to be as intelligent as possible goes, I hope, without saying; and it should also be evident that we need teach them practically nothing of a specifically vocational sort. They can pick up what they need of that sort after they enter employment; and they will pick it up much better if we send them forth from school as intelligent as we can help them to be.

The question then is, how can we best set about developing their intelligence? The answer, I think, is that we must appeal to them largely on practical lines and help them to learn through doing, rather than by ordinary classroom tasks. There has been too much tendency in the past to confuse manual with vocational education, and to suppose that setting a boy to carpentering is the same thing as training him to be a carpenter. It is nothing of the sort. Every boy ought to be a tolerable carpenter—or at any rate ninety-nine out of every hundred ought to be—and so ought a good few of the girls. Every normal man and woman ought to be reasonably handy at a wide range of everyday jobs, so as to be able to keep a home decent and in good order without having to send for a builder every time something goes wrong. And most boys and girls who have no special literary bent will, I am convinced, learn to be intelligent much more easily if the learning is linked up with doing real, practical jobs than if it is inculcated as something only remotely and theoretically connected with the ordinary business of everyday life.

It follows that a Modern School should not be just a building with classrooms in it, and a playing-field attached. It should be, as far as we can make

it, a place where there is scope for doing a great many different things—from cultivating soil or trees to building sheds and making furniture, laying roads, cooking, cobbling, painting scenery for a theatre, making costumes, playing in brass-bands or orchestras, handling a lathe or an electrical gadget—and all the while learning to do sums, to make a report in decent, plain English, to behave in a businesslike way on a committee, in close relation to the doing of these practical jobs. The Modern School ought to have many of the features usually associated with a Camp School, and it ought to be a social centre as well as a school, in close contact with the parents as well as the children.

If the Modern School is to be this sort of place, it will need teachers who can teach in the appropriate way—by doing things with the children, and not merely telling about them. We shall need to revise fundamentally our methods of training teachers, and also our ideas about the sources from which teachers are to be recruited. We shall need a good, even mixture of men and women—including married women—among the teachers, and a goodly number of them must know how to use their hands as well as their books. The Modern School must be neither the old elementary school under a new name, nor a pale imitation of the existing type of secondary school. It must be something essentially different and novel—something foreshadowed in the best Senior Schools that have been founded in recent years, especially in villages—something that will attract the practically minded man or woman who has an itch to teach, but is repelled by the conditions of the ordinary elementary curriculum and perhaps quite unsuitable for the Grammar School or the Technical School.

Of course, I do not mean that the Modern School must not trouble to teach its pupils the so-called “cultural” subjects. It must teach these subjects, but must teach them in such a way as to reach the imaginations of children whose bias is not literary, and who will learn them best if they are related to doing things, and not to books alone. If secondary education is to become universal, it must be broken away from its bookish tradition, which is appropriate to it only as long as it is meant to rest on a selective basis. It must be broken away, not because it is desirable for fewer people to read books, but because more people will read them of their own free will if they can be helped to see how the books are related to real things.

The school-leavers from our Modern Schools will constitute the first and the largest stream of entrants to employment. There must be plenty of room at any point for a Modern School pupil who shows a literary or a scientific or technical bent to transfer to a Grammar School or a Junior Technical School, or to proceed to one of the two at the leaving age instead of entering employment at once. But when this has been allowed for, there will remain the largest flow into employment at the school-leaving age, whatever it may come to be. Those who leave at this age will, however, in future not have their education stopped short, except for night school, when they enter employment. They will go on to a Young People's College, and will remain in attendance until they reach eighteen. Our next question, then, must be, What do we propose to make of these new Young People's Colleges that we are pledged to set up? Once more, it is important here to distinguish between the practical and the vocational; but the distinction has not quite the same bearing as it had in connection with the Modern School. The boy or girl who has entered an industry and been put to a job which makes some call for skill and intelligence will probably in most cases be keenest on a type of continued education that has some relation to that job. This is the experience with those who attend night schools or day classes for which they are released. But outside the recognised skilled trades, of which I am not now speaking, the proportion of jobs in industry, that makes this call for skill and intelligence is not high; and for the majority of boys and girls employed in fairly easy or mechanical jobs there is no such call to vocational training and education related to them as there is for the minority doing more exacting and interesting work. Accordingly, we cannot profitably think of the Young People's Colleges as largely engaged in teaching their

students to do or to understand their daily work better in any direct way. Where the job does need vocational training, by all means let it be given, either in a Technical School or College or in a special Works School, or wherever it can be given best; but such vocational training will have to be distinct from the ordinary work of the Young People's College, and to be provided for by extra time off, at any rate as long as attendance at the Young People's College is only for the equivalent of one day a week.

The Young People's Colleges will be of value in proportion as they achieve two ends—to make their students better citizens, and to equip them better to use and enjoy their leisure, both individually and together. It follows, I think, that in the Young People's Colleges a high place should be given to the arts, and there should be a very wide freedom of choice. The Young People's College will need to combine many of the qualities of the Polytechnic and the Art School with the features of a Club or Settlement. It will need to afford the maximum of opportunity for the spontaneous formation of groups and for the self-government that is the natural expression of vigorous group life. It will have to be a Youth Centre, for both sexes, as well as a school; and it will have to be wide open to the participation of voluntary bodies of every sort and kind—especially to all sorts of Youth Movements and to the agencies concerned with voluntary adolescent and adult education. It will need a good library, and a good stock of periodicals and magazines; a good theatre, equipped for film shows as well as for straight acting; good facilities for music, including a gramophone library as well as a concert hall; good shows of pictures and other interesting exhibits, frequently changed; plenty of visiting lecturers and speakers, especially those who can talk about everyday affairs in a practical way; craft rooms, laboratories, talking rooms where societies and committees can meet—and, above all else, a Principal and a staff ready to help in whatever turns up, rather than to insist on adherence to any fixed pattern of what ought to be done.

Here again there faces us a problem of right staffing; but it ought not to be a very difficult problem to solve. There will be plenty of youngish people of both sexes coming out of the services with just the qualities that will be needed in the Young People's Colleges—including former teachers who have been away from teaching and will feel like teaching differently when they get back. There will also be plenty of scope for part-time teachers engaged in other jobs, and for specialist teachers dividing their time between a number of Colleges, or perhaps between the Colleges and the Modern or Technical Schools.

I come now to the second stream of school-leavers—those who enter employment at or near the minimum school-leaving age, but proceed not to mainly unskilled work, but to the learning of a recognised skilled trade, whether or not it be one to which the entry is by way of formal apprenticeship. This stream will come, increasingly, from the Junior Technical Schools, though some of it will of course come from the Modern Schools—especially where there are skilled manual trades open to women as well as men. Now, we shall all agree that for the most part the best way of learning a skilled trade is by practising it in a good workshop (or on the job, as in the building industry) under proper supervision, and that courses in Technical Institutions are highly useful in supplementing this learning on the job, but much more so in some trades than in others. In general, the importance of the institutional side of the training is greatest in the mechanical trades; it is not, I believe (or am I wrong?) of equal importance in most branches of textile work. Junior Technical Schools will probably continue, even under the new system, to be for some time to come mainly boys' schools; and women will continue to come into the Technical Schools and Colleges mainly on the commercial side. In the case of boys, the great question that arises is that of the future of industrial apprenticeship: Will it continue to decay, as it has been decaying in so many trades, in face of developing mechanisation; or will there be a revival of it, as there seems some likelihood there will be in the building crafts? To the extent to which apprenticeship decays, the function of the Technical Schools and Colleges

becomes more essential in maintaining the supply of craft skill—for mechanisation does not remove the need for such skill, but as a rule demands higher skill from a smaller proportion of the total working force, and also, quite often, creates a demand for new skills for which no sort of apprenticeship exists.

The Junior Technical School, which will have to adapt its curriculum and conditions of entry to the new break at 11 *plus*, will tend to attract those boys who are intended to enter a skilled manual trade at the school-leaving age, together with others who will continue their full-time schooling until later. It is of the greatest importance that it shall be conceived, not in any sense as a Trade School specialised for a particular group of occupations—11, or even 13, is much too early for such specialisation to begin—but as a school with a mathematical and scientific bias related to the problems of the modern world. It should be linked up with a Senior Technical School, to which pupils can proceed easily without any sharp break, and should have its strongly marked civic and cultural side, using science as the gate to culture. Its standards, though different, should be intellectually quite as high as those of the Grammar School; and there is much to be said in favour of experiments in “multilateral” schools, linking together Grammar, Technical and Modern Schools on a common campus, with considerable common activities, especially on the civic and recreational side. It has to be recognised that under modern conditions the distinction between skilled and less skilled workers will tend to be less sharply drawn. There will be relatively fewer skilled tradesmen who have been regularly apprenticed to a craft at the one extreme, and fewer merely unskilled labourers at the other. The highly skilled will tend to differentiate themselves more, not as belonging to distinct crafts, but as possessing individually higher qualities and qualifications than their fellow-members of the same trade groups. These higher qualifications will be sought largely in the Senior Technical School or College; and the task of the Junior Technical School will be both to prepare the way for work in these institutions and to turn out a large body of highly adaptable young people who will be well fitted to turn their hands to new trades and processes, and ready to attach themselves now to one industry and now to another as the currents of demand change. They will differ from the products of the Modern Schools in that their education will have been based more largely on scientific and mathematical foundations, and that they will naturally gravitate more towards trades and occupations in which this sort of educational foundation is of special value.

I come back now to the third stream of entrants to employment—those who stay at school—Grammar or Technical, or perhaps in due course Modern, too—at least until they are 16, and when the school-leaving age goes to 16, to 17 at least or to 18. This is the stream from which at present are mainly recruited the clerical grades; and it includes also a substantial number from the Public and Grammar Schools and from Technical Institutions who enter the industrial system with better prospects than the general run of entrants and serve some sort of apprenticeship to the higher grades of administrative and technical work. For the cleverer and more enterprising of this third group, it is of the greatest importance to make fuller provision for continued education than has been made hitherto. For those who leave school at 16 or 17, we shall have to think out how we mean them to fit in to the system of the Young People's Colleges. Those of them whose bent is largely technical will probably want to carry on with day-time courses at a Technical College rather than attend a Young People's College; and many of the entrants to clerical and commercial occupations will also want to busy themselves mainly with vocational courses leading up to some special certificate or diploma. Their connection with the Young People's College will tend to be recreational and clubbish, rather than formally educational; and where they have a Technical or Commercial College to serve them as a social centre, they will probably not go at all to the Young People's College. But there is likely to remain a substantial body of late school-leavers for whom the Young People's Colleges will need to provide. This, I think, is where the voluntary

bodies providing adolescent and adult education ought to come in strongly, with forms of activity which will induce these young people to go on after they are 18 and especially with forms of civic education which will prepare for active citizenship a group at present apt to be singularly devoid of the sense of community.

For all this group that goes on at school beyond the minimum leaving age but stops short of a full-time University or Technical College education, the great thing is to provide ample chances for further education, full-time as well as part-time, at a later stage. There are plenty of people who leave school at 16, 17 or 18, and either feel at the time no strong urge towards further education, finding for the time being enough to do with mastering their jobs and living their private lives, or are for some years fully enough taken up with vocational courses for National Certificates or the like, but come in their twenties or even in their thirties to the point at which they know just what they want in the way of higher education, and will profit very greatly by getting what they want. There ought to be generous provision for releasing such persons and for financing them, not only to attend short "refresher courses," which can as a rule do no more than whet the appetite, but also for longer periods of full-time study at a University or Technical College, or perhaps, where suitable provision can be made, in the Research Association of the industry in which they work. Provision of this sort should not be confined to vocational work or to research; it should be equally open to those whose developing interests are in the arts or in any branch of culture. Much more use could be made of Universities and Colleges for *long* summer courses extending over several months, or for courses repeated for a month or two in the summer or perhaps at other times of the year over two or three years. The regular University and College staffs could not, of course, take on this additional work, which would have largely to be undertaken by teachers engaged in the forms of adult education that are for the most part shut down in summer, with such aid as could be rendered by the regular internal teachers and research staffs. There are administrative difficulties, I know; but it would take me too far afield from my main subject were I to attempt to discuss them now.

I must pass on to the fourth stream, or rather the trickle, that enters employment from the Universities or from the higher branches of the Technical College system. It is only a trickle; for I am not dealing with those who go on to the learned professions or to the Civil Service or to teaching or academic research, but only with those who enter gainful employment in industry or in services of an essentially economic sort. One important group comes in on the technical side, for research work in industry or for the higher technical posts in civil engineering, chemistry, metallurgy, electrical engineering, and so on. Another group, with or without scientific training, comes in to take up a position in the family business. A third, the smallest, comes in on the commercial or administrative side, usually of big firms with foreign as well as home business, and often to serve for at least part of the formative years abroad. These are the three groups of entrants by whom industry judges the achievement of the Universities; but they have only to be mentioned for it to be plain that they do not form at all a homogeneous unit. The boy (it is so seldom a girl that I can pass the girls over) who comes to a University in the expectation of succeeding to a position in a family business very often fails to make the best use of his time at the University, and that he so fails is quite often partly the parents' fault. It is also partly the result of an absence of connection in his own mind between the work he does at the University and the work which he will be doing afterwards, at any rate where he is not following a scientific course closely related to the basic problems of the industry he is to enter. The Universities, I think, do not put themselves about greatly to help him to see this connection, or to choose his studies with any regard to it. If he is naturally keen and clever, all is well; if, as so often happens, he is but mediocre in intelligence, he is apt to leave the University no better educated for life than he entered it, and perhaps with a bad attitude to work as well.



This does not apply to those who go out into industry from the Universities and higher Technical Colleges, not to succeed their fathers, but to make their own way. The trouble in this field—if it is one—is that, on the whole, the cleverest graduates would sooner do professional work or academic research work than enter industry, unless they can enter under exceptionally favourable conditions. Industry does not get the pick of either scientific or economist graduates, and is apt to complain of this fact. The plain truth, however, is that the number of first-class men is limited, and that if we are to increase the output we shall need many more first-class men as teachers, not only in the Universities and Technical Colleges, but also in the schools. There is, I feel sure, no dearth of natural ability, if not of the absolute first-class at any rate of a high second-class quality. Much of this is now stifled by defective educational opportunity and by social insecurity in the home. If we set out to end these conditions, and to actualise a much higher proportion of the potential supply of ability, we shall have to face, in the early stages, a bottleneck, in the form of a conflict of claims between industry and education for the services of the best men. It takes ability to develop ability; and it would be very short-sighted economy to starve the schools and Universities of able teachers just when they are to be given a better chance of having more of the right pupils to teach.

A part of the way round this difficulty is easier interchange. I am sure nobody ought to go straight from school and University as pupil to school or University as teacher and then stay at teaching for the rest of his life. This is worst of all in the case of the elementary school-teachers, who often go straight to a life's job in elementary teaching from a Training College to which they have come straight from school—a disastrously segregated way of living. But it is bad enough when a University graduate goes straight to teaching and thereafter teaches continuously until he retires. Those who teach ought to know life as well as books. They ought to have mixed, in work as well as in leisure, with people who are not teachers, but doers. They ought to have done, as well as taught. The vice I am speaking of is, of course, only one aspect of the vice of life-specialisation on a single job that pervades our social system. I made up my mind quite early that, though I wanted to teach, nothing should induce me to teach full-time. I have always been able to dovetail teaching with other jobs; and I am sure I have taught the better for it. We ought to make it as easy as we can for able persons to shift to and fro between industry and teaching, or between industry and research, or even to change jobs altogether for a few years in order to gain freshness and experience, without finding themselves shut out or heavily penalised by loss of pension for their refusal to sink into a rut.

You have probably been saying to yourselves for a long time past: What has all this to do with the textile industries? It has, I hope, a great deal to do with them. The textile trades have been in the past sharply differentiated from such industries as building and engineering in that they have employed very little unskilled adult labour and have consisted mainly of skilled workers, who have not however learnt their skill by any system of apprenticeship in the ordinary sense. In the cotton industry, the mule spinner, no doubt, has begun as a piecer, and the conditions in mule-spinning are not unlike those of apprenticeship in many respects. Weaving, on the other hand, has had no system analogous to apprenticeship since the decay of the handloom system; and there is nothing like apprenticeship in the preparing branches of the cotton industry. In the woollen and worsted trades spinning and weaving are alike trades without apprenticeship; and though there exist forms of apprenticeship in some branches of the lesser textile industries, the tendency is for them to decline. Moreover, as we look forward to the future of textile manufacture, it seems pretty safe to prophesy that the degree of skill required of the general run of operatives will decline. Ring spinning and the automatic or semi-automatic loom will gain further ground: rayon, staple fibres, and other substitutes will reduce the employment in the spinning of cotton and wool. Mechanisation will advance further in most branches; and the main demand of the industry, except in a few branches, will

be, rather for adaptable machine-dexterity than for high and diversified kinds of skill taking a long time to learn. On the other hand, a high quality of skill will be demanded in those who maintain the machines and supervise the work ; and there will be a considerable increase in the demand for skilled chemists, technicians, research workers, and designers.

What changes will these conditions call for in the structure of education in the textile areas ? At the top end, they will call for a greatly increased provision in Universities and Technical Colleges and in Art Schools specialising in industrial design. They will call for better provision for picking out the promising worker, through whatever channel he has entered the industry, and at whatever age, and affording him (or her) the opportunity of study, part-time or full-time, in order to become capable of higher types of work. They will call for more research-minded directors and managers and supervisors in every branch of the industry, and for higher scientific qualifications, without which the bearing of advances in the research field cannot be understood or the lessons applied. So much is obvious ; but it is much less obvious what the textile industries will require of the main body of entrants who come into employment at or near the minimum school-leaving age. They will in fact require little that is not the common requirement of most types of industry. Their main needs will be for general intelligence, for keenness based on good physical and mental health, and for adaptability and a willingness to try new things and to look forward rather than back. They will, if their leaders are wise, want their operatives to have the widest possible range of outside interests and concerns, in the knowledge that work will be best done if the lives of those who do it are full and happy. In effect, the requirements of the textile industries from the general system of public education are, unless I am greatly mistaken, that the schools shall be as good as they can be made, and shall provide, not any form of vocational preparation, but the best possible mind-widening and the most forward-looking preparation for the arts of life.

Let me end on a more general reflection. We are moving forward towards a new educational system which is meant to embody, and to foster, democracy. This means that our education must be closely related, not for a few but for all, to the pressing problems of our own age and must be directed primarily to the understanding of the foundations of modern living. That is a very different ideal from any that we have pursued hitherto, except for a very few. Our teachers and educational propagandists have, no doubt, laid great stress on the understanding of the child mind, and the greatest advances in teaching method have, I think, been made in dealing with the younger children. Our better Primary Schools understand their job, I fancy, a good deal better than the general run of our Senior and Secondary Schools ; for there has been much less practical progress in the study of the adolescent, and the higher age ranges of our school system are much more hampered by traditionalism and by examinations which are a reflection of it than the junior ranges. The classical tradition is still too much on top of our secondary education ; and the selective entry to the secondary school has made havoc of the work done in the middle ranges of the elementary system. Some excellent work, as I have said, has been done in Senior Schools ; but only here and there. We have failed to realise that education as a whole needs re-casting in the mould of modern discovery and of modern ways of living, and that the democratisation of the educational process must be something very different from an extension to more and more children of a tradition which is basically aristocratic and increasingly out of touch with modern reality. What, however, we must above all avoid is a confusion—so often made—between the modernisation of our schools—their adaptation to the key problems of modern living—and their vocationalisation. Modern industrial society calls, on the whole, not for more but for much less specialised vocational training of the great majority of those employed in it. The need is for greater power to apply the intelligence, for more versatility, for more liveliness of mind, and for a keener sense of responsibility and of social function. These, primarily, are the ends we ought to pursue ; and I see no reason to believe that the textile industries will profit less by them than the community as a whole.

## Reviews

**Review of the Annual Reports of the Society of the Chemical Industry on "The Progress of Applied Chemistry," 1942.**

On reading through the Annual Reports for 1942 of the Society of Chemical Industry, section by section, page by page, the textile technologist cannot fail to realise that his own field of activity is rapidly and continually widening, and impinges on every section of applied chemistry covered by the reports, and from which he can glean much useful information.

If the Annual Reports had been compiled primarily for the textile man, then the arrangement of the information would naturally have been very different, and much of it would have been extended and much deleted. All this is obvious, but points to the potential value of annual progress reports written specifically for the textile man. This comment is not intended as a criticism of the present format of the S.C.I. Annual reports, which are written for the industrial chemist, and not specifically for the textile technologist.

The section dealing with glass contains much information of interest. It is gratifying to note that intensive research work is proceeding on a substance of such vital importance in the laboratory and works. There are references to glass fibres and cords on pages 187, 188, and 191, and it is considered that this aspect of glass technology is worthy of a subheading, even though reported for industrial chemists and not specially for textile technologists.

Analogously it is considered that the information given in the Plastics section on pages 289, 299, 301, 302, and 308, on laminated fabrics could with advantage be collated under one sub-heading.

Amongst other miscellaneous references relevant to textiles technology, are the following:—the use of a multi-effect "weatherometer" for testing rubber (page 356), boiler feed treatment (page 23), water-softening by means of synthetic resins (page 471), filtration of water (page 473), and other liquids (pages 18, 19), the examination of fluid flow through textile fibres (page 5).

In the section on "Intermediates and Colouring Matters," Dr. Fraser Thompson has adopted a new procedure by not reviewing dyestuff intermediates *per se* in a separate section, but includes some of them in the appropriate sub-sections on dyestuffs. This is considered to be an improvement as it facilitates the reading of progress in this field, especially by chemists not directly concerned with the dyestuffs industry.

"Fibres, Textiles and Cellulose" is naturally the most interesting section to Textile Chemists, and with one or two exceptions is a comprehensive review of the papers published during 1942. The sub-sections on "Protein rayons and related Fibres" (page 117), and on "Chemical Constitution," (page 113) (Cellulose Textile Chemistry) are particularly able and succinct accounts of the present knowledge in these fields. It is obvious that the protein rayons are receiving considerable attention at the present time, particularly relating to attempts to improve wet strength. It is suggested that a more appropriate title for "Cellulose Textile Chemistry" is "Cellulose Textile Technology," since a number of non-chemical subjects are dealt with, such as the physical properties of fibres and fabrics, including thermal properties (page 122).

The use of acetone in the xanthation of alkali cellulose, described on page 126, is reminiscent of its successful use as a medium in the simultaneous deacetylation and methylation of cellulose acetate. Incidentally, it is interesting to note that the chemical tools of methylation and methylenation successfully employed on the cellulose problem are now being applied in the elucidation of a still more intractable problem, namely, the chemical constitution of keratin (pages 109, 110).

In the cellulose "Dyeing" sub-section, the use of synthetic resins in pigmented emulsions for dyeing and printing is very properly stressed, and also the use of a lacquer phase to prevent migration of pigment during dyeing. There are two notable omissions, however, from this sub-section, namely, the work of Usher and Wahbi, on the role of salts in the dyeing of cellulose (a discussion on electrostatic effects in the dyeing process (*J. Soc. Dyers & Colourists*, 1942, page 122), and C. M. Whittaker's paper in the *J. Soc. Dyers & Colourists*, 1942, page 253, in which directly dyestuffs are classified according to their salt sensitivity and levelling properties.

It is gratifying to note that many references are made to the Textile Institute Standardisation work, viz., measurement of shrinkage (page 113), waterproofing

(page 115), evaluation of cloth characteristics (page 117), and analysis and identification of fibres (pages 121, 122), showing that definite progress has been made in this field during the year.

H. A. THOMAS.

**Wool: A Review of the Past as an aid to the Study of the Future.** New Zealand Loan and Mercantile Agency Co., Limited. (New publication, London, 1944).

This booklet, prepared primarily for those not engaged in the wool merchanting side of the trade, fully merits careful consideration. A digest is given of official figures regarding the production and use of wool in the chief wool growing and processing countries; as well as of the machinery and labour available. Comparison is made of the fluctuations in the price of wool and other commodities, together with notes upon the political and financial events which influenced those prices; the comparison is not unfavourable to wool. It is shown that Britain is not only the world's largest importer of wool, but, a fact not always realised, she is the seventh or eighth largest producer of wool (111 million lb. in 1938, of which 28 million lb. or over 25 per cent. was exported). The retained home wool represented one-sixth of the wool used in British industry. The yield per sheep in Britain is much lower than it is for instance in Australia and New Zealand, and there would appear to be little doubt that it could be greatly improved. It is noteworthy that the production of wool increased by 65 per cent. in the 20 years preceding the war. The world consumption of wool has gone down during the war, half the wool processing machinery of the world being now under German control; and the largest individual industry, our own, being rigidly restricted. There is thus a considerable surplus of wool piling up but there is every probability that at least during the first few post-war years the demand for wool will be on a hitherto unknown scale and, in fact, shortage of machinery and trained labour may very well be one of our greatest difficulties. Cessation of exports of manufactured wool goods from Britain and Europe has led to the large wool exporting countries greatly increasing the processing of their own wool; for example, the Argentine has nearly doubled its pre-war consumption of wool and it now processes over 20 per cent. of its own clip and, in addition to raw wool, exports yarns and fabrics to other South American countries and to South Africa. It would seem that the effect of synthetic fibres on the wool trade has been greatly exaggerated in some quarters, but whatever danger it presents there is only one way of combating it. Rayon and the synthetic fibre industry (nylon, etc.) were born of and bred by research and to research they still cling for nourishment, strength and increased growth. It is no exaggeration to say that there are British firms of rayon or synthetic fibre manufacturers who each individually spend more in a year on research than do the combined wool industries of the world, certainly one firm alone is spending much more than ten times the amount spent by the whole of the British wool industries.

It is pointed out that the U.S.A. is the only country which requires goods containing wool to be plainly marked with the percentage and composition of the fibre content. This is an example which might well be followed here both to the advantage of the trade and of the public. The latter assumes that "woollen" means made of wool but to the trade it means quite a different thing. To the Government it means different things at different times. According to the Consumer Rationing (Control dated) Order, 1943, a fabric composed of 85 per cent. cotton and 15 per cent. horsehair may be described as woollen! The whole use of the word woollen is a mass of contradictions, to the detriment of the maker of all wool goods and often to the confusion of the public. The booklet fully fulfils its declared object of collecting and presenting in a convenient form some salient facts of the past to form a foundation for consideration of the future. It is well worth study by each and every member of the Institute both as technologist and as a citizen of a country whose fortunes throughout history have so very largely depended upon its having flourishing wool industries.

C. O. CLARK.

## Institute Membership

The following applicants were elected to membership at a recent meeting of Council:—

### *Ordinary.*

Gathorne Dixon Barrow, Messrs. Flinn & Son Ltd., Fishersgate Dye Works, Brighton (Chemist, Local Director).

Arthur W. Dymond, "Tweenways," Rackenford Road, Tiverton, Devon (Assistant Manager, John Heathcoat & Co., Tiverton).

- Norman H. Fairbairn, Messrs. Keddie Gordon & Co. Ltd., Rosebank Mill, Galashiels (Tweed Manufacturer).
- William Henry Green, 760, Walmersley Road, Bury (Doubling Manager, Water-side Mill Co. (Bury) Ltd., Wellington Mill, Bury).
- Frederick Hugh Howorth, Roscoe House, Anderton, Nr. Chorley (Heating and Air Conditioning Engineer, James Howorth & Co. Ltd., Victoria Works, Farnworth, Nr. Bolton).
- Nitya Nand Karan, Baraampur, Aurangabad, P.O., Dist. Gaya (Bihar), India (Supervisor of Spinning and Carding, Madura Mills & Co. Ltd., Madura, S. India).
- Fred Kershaw, Race Course Road, Coimbatore, S. India (Textile Manager, Cambodia Mills Ltd., Singanallur, Coimbatore, S. India).
- Maurice Lorrimer, 2, Spencer Road, Coventry (Director, Messrs. Pool Lorrimer and Tabberer, Lockhurst Lane, Coventry).
- William George Macmillan, Ph.D., B.Sc., F.R.I.C., Research Institute, Indian Jute Mills Association, 16, Old Court House Street, Calcutta, India (Chief Chemist).
- A. S. Marquart, 2, Embankment Gardens, London, S.W.3 (Fibre Manufacturer, 109, Battersea High Street, London, S.W.11).
- Charles William Nowell, 5, Douglas Street, Bolton (Heating, Ventilating and Air Conditioning Engineer, James Howorth & Co. Ltd., Victoria Works, Farnworth, Bolton).
- David Pike, c/o David Pike & Co. Ltd., Ebor Mills, Dubb Lane, Bingley (Manufacturer).
- John Pollitt, B.Sc., 15, Delamere Road, Gatley, Cheshire (Research in Textiles, British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester).
- Aubrey Fred Smart, 57, Cutenhoe Road, Luton, Beds. (Textile Chemist, B. Laporte Ltd., Kingsway, Luton).
- Josef Stross, 7, Claremont, Bradford (Weaving Overlooker, Holme Top Mills, Bradford).
- Clarence Rallisom Wilkinson, I.C.I. Ltd., Shell-B.P. House, London Road, Leicester (Technical Representative, Dyestuffs).

## John Dodds Athey

## Obituary

The Textile Institute suffered a severe loss when, in 1936, illness deprived it of the services of J. D. Athey. His death, recently, will be deplored by all who knew him and it is perhaps fitting that the sad occasion should be marked by putting on record some tribute to him by one who knew him well.

He was actually born at Newcastle-on-Tyne, but his family moved to Bradford when he was very young, so that his school days were spent in the Yorkshire city. He used to remind Mr. W. W. L. Lishman, for so long Treasurer of the Institute, that they were both pupils of the same school. Off duty "J.D.A." was a most interesting companion and his fund of reminiscences and stories included many of his early boyhood and working days.

Returning to Newcastle, he became a journalist, and all members of that profession will understand when it is recorded that he was a journalist at heart to the very end. He knew what was "a story" and how and when to put it out. As a journalist he pursued his profession, as sub-editor on the *North Eastern Daily Gazette*, on the reporting staff of the *North Star*, and later as Editor and Manager of *The Auckland Times*.

When that organ was amalgamated with the *Auckland Chronicle*, through the activities of the late Arthur Henderson, Athey went to London as a "freelance." A full record of his work in London, for the *Morning Leader*, *Lloyds Weekly*, and a host of other journals would be too long for an article of this character, but there can be no doubt that he was indefatigable, ubiquitous and in every sense of the word a "good and successful journalist." His ver-

satility was proven by his work as Editor of *The Grocer* and for *Footwear*. His recollections of such well-known personalities as Sir William Eden (father of Anthony Eden), St. John Ervine, G. K. Chesterton, Lord Justice Darling, and many others, made him a most welcome companion on those occasions when men foregather after meetings and conferences to spend a social hour or two together.

The Great War cut right across the work of all free lance journalism, and it was then that Athey turned his thoughts to the North again. In early 1915 he was appointed General Secretary of the Textile Institute and Editor of its *Journal*. No finer tribute to his work could be paid than by a comparison of the "J.T.I." from 1911-1914 with the same *Journal* from 1915-1918. As a journal in the professional sense and as the organ of a learned Society the metamorphosis was complete and masterly.

The Textile Institute is founded on certain sure foundations; its Charter; its Diplomas; its *Journal*; its Sectional activities; its National Certificates; and its Competitions. Its finances are modest perhaps, but they too are founded on a rock. Behind all this lies the quiet enduring work of John Dodds Athey, and it is but right and proper that this should be recorded in the *Journal* of which he was justly proud and thus put on record for all time.

The writer joined him in 1923, coming as Editor of the *Journal* when the work of the Institute as a whole necessitated a sub-division of the tasks involved. Though he relinquished the Editorship then, and later handed over the management side too, he never lost interest in the work and was always its most stern critic.

To the end of his 21 years' service with the Institute he wrote everything that had to be printed so meticulously, that all the compositor had to do was "follow copy" and woe betide him if he did not.

Whatever may be the heights to which the Institute may rise, and its well-wishers see no "ceiling" yet, it should never be forgotten that the man who focused and co-ordinated the efforts of those loyal voluntary workers who have given so much of their time to its service, and who helped to fashion and lay its sure foundations was John Dodds Athey.

HUGH L. ROBINSON.

### Employment Register

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application.

- No. 235—Member, holding Diploma in Dyeing, with practical experience in chemistry and dyeing, desires position with dyestuffs and chemical manufacturers with view to later position in connection with technical sales and services abroad.
- No. 236—Associate desires position as Assistant Manager or Inside Manager in Cotton Spinning Mill. Age 42 years. Knowledge of weaving, knitting and finishing processes. Good experience of modern spinning machinery. Sixteen years' experience as head spinning overlooker. Excellent references. Accustomed to handling labour.

### Vacancy

TEXTILE CHEMIST required by large Textile Firm. Duties will include the operation of a well-equipped textile laboratory for routine laboratory work. Opportunity for work on research in collaboration with Textile Research Associations. Applicant should be fully trained and hold appropriate scientific qualifications. Permanent position and suitable salary for the right man.—Box No. 67.

## NOTICES: INSTITUTE MEETINGS

### LANCASHIRE SECTION

Friday, 9th June—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's premises. "Patents and Textiles," by W. A. Silvester, M.Sc.

# THE JOURNAL OF THE TEXTILE INSTITUTE

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## PROCEEDINGS

### Lancashire Section RINGS AND TRAVELLERS, 1932-1944

By DONALD EADIE

*Paper delivered to the Lancashire Section, 11th February, 1944.*

Twelve years have now passed since I had the pleasure of reading a paper on Rings and Travellers to members of the Textile Institute, and it has been suggested that the subject should be brought up-to-date.

As you are all connected with the textile trade and probably would not be here if you were not concerned with ring spinning or twisting I will not waste time by describing the ring and traveller combination. Let it suffice to say that you require of the combination that it should provide tensions variable at will within fairly wide limits, but of the utmost uniformity under any given set of conditions. These requirements are met by controlled friction between a smooth and regular ring in conjunction with various weights and shapes of traveller.

The ring makers aim at maximum smoothness in order, first, to cut down the running-in period, and secondly, to keep traveller wear as low as possible—hence the various mirror and super finishes. Other things being equal, the ring which permits the use of the heaviest traveller for a given count is generally considered to be the best ring.

The traveller makers' job is to supply friction in exceedingly well regulated quantities, and they do this by giving spinners and doublers a choice of some thousands of different weights and shapes of traveller weighing from 4 to 40,000 grains per 100. For example, the spinner who finds that travellers weighing, say 8 grains per 100, which do not give the results required, may substitute others weighing 7 or 9 grains.

If the ring makers' ideal is roughly the elimination of friction then the traveller makers' ideal is to produce an article which will give uniform tension and reasonable life on any set of uniform rings. The fact that the rings may be from any one of twenty different makers and of any condition from brand new to worn out or even reconstituted is an added complication.

A recent lecturer at the Institute stated that the average age of existing mills in this country is 40 years; that only five new ones have been erected here since the last war and that the newest of these is already 18 years old. So far as spinning is concerned therefore, there have not been many opportunities for gaining first-hand information on up-to-the-minute frames. In the modern spinning frames that we hope to see in Lancashire after this war, the principal changes which could affect the performance of the traveller will be larger rings, longer lifts, rising and falling lappets, higher and perhaps variable speeds. My information from the United States is that in the last 12 years about 10 per cent. of installations have had variable speed and 80 per cent. to 90 per cent. have had high drafting. It will be interesting to see whether in the course of modernisation Lancashire follows the United States by adopting the No. 1 flange spinning ring on the same large scale. Our normal ring is the No. 2 flange with a flange width of  $\cdot 156$  in. to  $\cdot 163$  in., according to maker. The

No. 1 flange measures  $\cdot 125$  in. and permits the use of smaller, sturdier travellers. Up to now in this country this narrow flange ring has enjoyed only limited popularity and that mainly in fine count spinning, but the Americans use it down to 30s and even to 20s counts. There have been some recent trials here with still narrower flanges—for instance, No.  $\frac{1}{2}$  flange at  $\cdot 109$  in. and No. 0 flange at  $\cdot 0937$  in., and these, of course, called for exceedingly small travellers which were difficult to handle. We were not informed of the nature of these trials, but we gathered that the object in view was definitely not finer counts.

One innovation in the spinning trade during the last 12 years was the introduction in Germany of the Patent N Traveller. This was a kidney-shaped traveller with a depression in the centre of the back. The idea was that at the top of the chase where tension was high the traveller ran in the conventional semi-floating position. When winding was taking place on the bottom of the chase and tension was lower, the traveller keeled over until the pip in the back came into contact with the top of the ring and so increased the drag. These travellers enjoyed considerable success in Central Europe, where nearly 2 million spindles went over to them. They had no success here or in the U.S.A., even when tried under what appeared to be the most favourable conditions. The principal defect was a tendency to fly off, and if this was corrected its only merit was lost.

During the same period there was also a revival of interest in the Elliptical Spinning Traveller. This shape combines free running characteristics with an excellent grip of the ring flange. When using an Elliptical Traveller it is frequently necessary to employ one, two or more sizes heavier than with the C shape in order to obtain a given tension. Weight for weight it is the most difficult to dislodge from the ring, but it is rather stiff to put on in the heavier numbers. In theory it would appear that the best use could be made of this style on fine count spinning, where a traveller several sizes sturdier and with a better grip might be advantageous. I am not aware that anyone uses it specially for this reason.

In my 1932 paper, mention was made of the short life of flanged rings when working with silk. I reported having seen four different makes which had all worn out in under six months. Some time later a case was reported from America in which rings of two different makes had been completely worn out in three weeks when working with spun rayon. The user said this rayon had evidently thrown off an abrasive substance which accounted for the wear. Since that time Professor Honegger, of the Federal Institute of Technology, Zürich, has thrown some light on the subject in a paper published in the *Textile Manufacturer* of July, 1935. As a result of his investigations he found, unexpectedly, that the coefficient of friction does not depend merely on traveller speed and pressure, but also on the quality of yarn in operation. A smooth yarn like rayon results in the highest tension. A comparatively rough yarn like cotton gives relatively a very much lower tension. The theory was advanced with some supporting evidence that the rougher cotton yarn imparts a little vibration to the traveller, which results in lower average tension. As tension means friction and friction means wear we have here a plausible explanation for the occasional quick wear of unlubricated flange rings on special work. Professor Honegger also referred to the widespread belief that the quicker wear of rings on rayon or silk might be due to the hard dust given off, which contains no natural lubricant as does that from cotton yarn. He stated, however, that it would "not be easy to prove either of these hypotheses."

It is unfortunate that he did not complete his experiments and write the second article which was promised. As matters stand, we know of no proof that spun silk or rayon throw off any abrasive substance, but there has been some quite recent evidence that very smooth yarns, even cotton ones, cause higher tensions, and therefore, presumably, more wear on ring and traveller.

There is no doubt at all about the effect of abrasives, and I recall a case of rings being worn out in less than a year when spinning a woollen carpet yarn.



This yarn was found, on analysis, to contain 1 per cent. of sand. The firm's consumption of heavy steel twisting travellers was such that they thought it worth while to save the worn ones for mixing with the concrete of their new floors. It is feasible that a dirty cotton yarn could have the same effect.

There is also some evidence that the hard metallic dust from the travellers themselves acts as an abrasive and may, therefore, be a contributory cause in cases of quick ring and traveller wear.

Wear can be kept to a minimum by attention to the following points:—

- (1) Employment of the best style of ring and the correct size and shape of traveller for the work in hand.
- (2) Changing travellers before they are on their last legs.
- (3) Regular cleaning of rings.

When we come to the Doubling Ring and Traveller it is possible to say definitely that there have been considerable changes and much development in the last 12 years. In 1932, for example, there were really only two depths of doubling rings in large scale use over here. These were the standard depth of  $\frac{3}{4}$  in. for cotton and the small section depth of  $\frac{1}{2}$  in. for worsted and silk.  $\frac{3}{4}$  in. deep and 1 in. deep rings with their 25 per cent. and 50 per cent. longer bearings were just coming into use in large numbers for cord doubling and cabling. Since then we have seen the small scale introduction of  $1\frac{1}{2}$  in. deep rings for extra heavy duty and  $1\frac{3}{4}$  in. deep rings for extremely fine work. By making full use of all six ring depths, twisting can now be carried on efficiently with ear-shaped travellers weighing anything from 15 grains to  $6\frac{1}{2}$  lbs. per 100. New twistors for rayon tyre cords in the United States are being equipped in some cases with  $1\frac{1}{2}$  in. deep rings, but this depth has not made its appearance over here.

During the 12 years under review the principle of wick feed lubrication has been greatly improved and applied in one form or another to well over 2 million rings. The Americans began by developing the shallow rings for pure silk, rayon and worsted. The Germans concentrated on the deep rings for tyre cords and were the first to make large scale use of variable speed drive. The home market bought first the standard depth for fine and medium cotton counts. Subsequently each market extended its use of the principle by applying it in the other directions. Spindle speeds on doubling frames rose sharply and the traveller had to be completely redesigned to meet the calls made upon it. Shortly before the present war a new style of grease-lubricated doubling ring was put on the market with multiple grooves to hold the grease on the bearing surfaces. This ring made use of the improved styles of traveller evolved for the oiled ring and has enjoyed a considerable measure of success. Its introduction coincided with the increasing use of penetrants in the trough water and it gives an excellent account of itself even under the wettest conditions of doubling.

Various attempts have been made with this and other doubling rings to introduce one shot or grease gun lubrication, but there are a number of technical difficulties and the principle has not been good enough to catch on. For the moment you must be satisfied with hand greasing at longer intervals.

To obtain the utmost benefit from the latest designs of doubling rings it would appear to be necessary, or at least desirable, to adopt variable speed drive. With the old plain ring the diminishing supply of lubricant towards the end of the doff counteracted the reduction in drag due to the improved angle of pull. With these new rings there is no important falling off in lubrication towards the end of the doff so that the tension falls as the bobbin increases in diameter. The Germans were quick to realise that advantage could be taken of this fact to raise the spindle speed as the doff proceeded and so maintain a fairly constant tension. Hence their adoption of variable speed drive.

One of the new high speed doublers now on the market is fitted with separators which completely encircle the balloon. I have seen such a frame operating with  $3\frac{1}{2}$  in. rings at spindle speeds in excess of 7000 r.p.m. and with

travellers fully 40 per cent. lighter than one would expect for the particular counts. I think, therefore, that the idea has a very definite future in permitting the use of travellers light enough to avoid overloading of the ring and traveller contacts at high speed.

There has been a revival of interest, too, in doubling rings of conical section, larger in diameter at the bottom than at the top, evidently with the idea of relieving traveller pressure on the bottom of the ring. First patented by Kirkpatrick in 1904 there have been two recent patents embodying this design.

The progress made in the design of Doubling Travellers has been remarkable. The old type with big head and small tail, which was good enough at medium and low speeds, overbalanced badly when speeds were raised so that all the load was taken by a small area near the knee. A much better balance was evolved by stages. This distributed the load evenly over the available ring surfaces, thus greatly easing the strain on lubrication systems and reducing the risk of brassing. Speaking from memory, I would say that several years must have passed since a case of brassing was brought to the notice of my firm, and I feel sure the improvement must be general. To back up the foregoing remarks on the improvement of doubling traveller shape, I cannot do better than quote one remarkable example:

In 1935 we were assisting a customer with some rayon experiments on shallow depth self-oiling rings of  $5\frac{1}{4}$  in. diameter. The travellers were running at the highest speed of which we have any record, viz., 194 ft. per sec., and their life was 8 hours. The customer badly wanted 16 hours. We redesigned the traveller and it gave, not 16 hours, but 100 hours' life, during which it covered something over 13,000 miles.

It may be of interest at this point to take note of a few high traveller speeds. Taking 100 ft. per second as our starting point, we have four examples of cotton doubling between that and 120 ft. per second, of which the highest is a bicycle tyre yarn being twisted on  $3\frac{3}{4}$  in. rings at 7000 r.p.m. minimum to 8000 r.p.m. maximum with variable speed drive. In this speed range there is one case of worsted twisting at 5500 r.p.m. on  $4\frac{1}{4}$  in. rings and one of wool spinning at 5100 r.p.m. on 5 in. rings. There are also many cases of silk throwing at 10,000 r.p.m. on  $2\frac{3}{4}$  in. rings. The present high speed range for rayon is from about 100 to 150 ft. per second. This group includes spindle speeds all the way from 6500 r.p.m. to 9000 r.p.m. on 4 in. rings and up to over 10,000 r.p.m. on  $3\frac{1}{2}$  in. rings. In some cases the material is 100 denier single end rayon 30-60 turns, and in others 20-22 denier rayon 2 and 3 thread. All this rayon data comes from the United States, though I dare say the speeds can be matched over here. All these examples are for lubricated rings of the so-called doubling shape, using ear-shaped travellers. With the unlubricated spinning combination, speeds are very much lower. For the ring sizes in general use in this country the peak remains about 75 ft. per sec. Higher traveller speeds are possible on larger rings, and we have a few examples from the United States of big package spinning of cotton counts 8s to 16s up to 97 ft. per sec. Unfortunately, oil lubrication cannot be applied to cotton spinning rings on account of the oily fly which accumulates on ring and traveller. A good but exceedingly expensive oiled ring of the flanged type was produced in Germany, and although it was a beautiful job it had no greater success than previous attempts, though I was given to understand that it did quite well with worsted.

In my 1932 paper mention was made of the theory that light travellers wear the rings more quickly than heavier ones. Strong supporting evidence to this effect was given some time later by several writers to the American paper, *Cotton*, in answer to a questionnaire. Recent experience suggests that this theory should at least be accepted with caution. At any rate, I have examined rings used exclusively for very fine cotton counts on which no wear could be measured nor any waving be seen after 9 years' continuous use. Perhaps it is only the use of too light a traveller for a given count which causes rapid wear

by inducing "chatter." You may say that spinners should know what size of traveller to use, but I remember reading a statement by a foreign traveller maker that, as the result of many mill investigations in his country, he was satisfied that a high proportion of firms erred on the light side by one or two numbers. If you doubt that a light and chattering traveller can seriously damage a hard ring, let me quote a case that came under my own observation. In the course of a few weeks new rings had a fine pitch wave worn in them rather like the milling on the edge of a coin. This was removed and a fresh start made with heavier travellers. There was no more trouble, but the manager, to satisfy himself, tried a few of the light travellers again, and the rings showed plainly visible signs of the old trouble after only 16 hours. Although this was a twisting and not a spinning job, I can readily believe that the same principle applies to both.

In my last talk I quoted the result of rather an extraordinary test carried out by some friends in the United States. A frame was fitted with new rings. One side had rings picked for roundness. The other side had rings which were considerably out of round. The result of the test was surprising, inasmuch as the side with the unround rings beat the other side handsomely in ends down over a three weeks' run.

It may also surprise you to learn that, from our own experience, there is some evidence that both rings and travellers can be too hard. The quite natural opinion is that, for long life, both rings and travellers should be as hard as possible. We once shared that view, but are not so certain now. A Continental ring maker marketed nitrided rings but, after tests, the users reported that they never got "run in." We ourselves had a test lot of nitrided rings run against a similar quantity of the standard article in an English mill. Both lots were weighed before and after the test by the National Physical Laboratory and the result showed that more wear had taken place on the super hard nitrided rings than on the regular article. Again, we have made travellers from high speed steel which came out poorly on test. It may be, of course, that, apart from the question of hardness, such alloyed materials as nitriding steel and high speed steel are unsuitable for making rings and travellers.

I should like to end this talk with a plea for much closer observation of ring and traveller performance by all users. Not only would they help themselves but if they passed on their observations they could also help the trade as a whole to a better understanding and a fuller knowledge of this sometimes mysterious and tricky combination.

No expense is involved—only a certain amount of trouble. Where new rings have to be bought it is worth making certain that the final selection is the most suitable size and type. So far as the travellers are concerned there is a big range of choice in weight, shape and size of bow. A fairly safe rule would be to take nothing for granted except the *quality* of the ring and traveller! You have already heard how one firm had its traveller life raised from 16 to 100 hours. Let me quote the experience of another firm. They wanted a lot of new rings, but thought some previous supplies were not the most suitable. It turned out that they were quite right, for a trial of four different alternatives, all of one make and of the same diameter, showed a difference in performance between best and worst of 128 per cent. as measured by ends down from all causes. I have quoted this case in order to emphasise the far-reaching effects of test and selection. All the rings and the travellers were absolutely standard lines and it was the selection of the best combination for the work in hand that gave the fine results. Counting ends down is like taking the temperature of a patient. It shows at once what the position is. For easy comparison the basis should be ends down per 1000 spindles per hour.

Both the ring maker and the traveller maker have put a great deal of research into their products, but it has mostly been of a metallurgical and theoretical nature. It must be left to the spinners and doublers to pick the most suitable combinations for their particular work and to keep the makers informed on the practical side.

## Review

**A Century of Carpet Making.** F. H. Young (James Templeton & Co., Glasgow).  
This book is an abstract record of the history of James Templeton & Co., Carpet Manufacturers, Glasgow.

It is a publication for mature and understanding readers. The carpets produced by this firm were multifarious.

A brief and excellent treatment is given of hand and machine made carpets of loop and cut piles, and non-pile Scotch carpets.

The special features of mechanism, development and difficulties associated with the production of Brussels, Wilton and tapestry carpets of loop and velvet structures are effectively dealt with and generally well considered.

The development and progress of Spool Axminster is a most notable example of carpet manufacture. The details of structure and modifications of mechanism, improvements and extensions are distinctly explained.

The introduction of the patent Chenille Axminster, saturated with a legion of structural operative and mechanical difficulties, was an epochal event in carpet making.

The records in this in this interesting publication, might aptly be used for a larger and more comprehensive post-war issue, which should be well illustrated and contain line diagrams of essential machine parts as well as perspective views of the Spool Axminster and Chenille looms.

FRED BRADBURY.

## Notes and Announcements

### Honorary Secretary—Resignation of Mr. F. Nasmith

On medical advice Mr. Frank Nasmith recently tendered his resignation from the position of Honorary Secretary of the Institute and from all Committees. It was with much regret that the Council accepted the resignation. Mr. Nasmith filled the position of Honorary Secretary for a period of fourteen years and his vigour and guidance will be missed at the Council and Committee meetings. Fortunately his services in an advisory capacity will still be available.

As a token of the Institute's appreciation of the valuable work which Mr. Nasmith has done over a long period, the Council unanimously elected him to Honorary Life Membership of the Institute.

### Officers

At the May meeting of Council the following officers were elected for the ensuing year:

Chairman of Council—H. G. Greg.

Vice-Chairman of Council—A. Draper.

Hon. Secretary—W. Kershaw.

Hon. Treasurer—W. Howarth.

### Scholarship in Cotton Spinning or Weaving

In accordance with the terms of a grant from the Cotton Reconstruction Board and the Trustees of the Cotton Trade War Memorial Fund, the Council of the Textile Institute offers to young craftsmen engaged in the Cotton Spinning or Cotton Weaving Industry of this country a Scholarship extending for not more than three years and of a maximum annual value of £200 prior to the final year and £350 for the final year, the amounts to cover maintenance allowance, college fees, travel expenses, and any other incidental charges.

Applicants, who must be of British nationality, must have obtained the Full Technological Certificate (Cotton Spinning or Weaving) of the City and Guilds of London Institute and must be prepared to present themselves for Oral Examination by the Textile Institute.

The Scholarship is open only to applicants under 24 years of age, whose textile technical education has been limited to Evening-Course instruction or Day-Course training secured by Scholarship from Evening-Course studentship.

The Scholarship will be in the form of an approved course of study and/or extended training of special character or industrial experience at home or abroad.

Forms of Application, Conditions, and other information may be obtained on request from the Acting General Secretary, The Textile Institute, 16, St. Mary's Parsonage, Manchester, 3, and applications must be received on or before 4th August, 1944.

### Patents Committee, 1944

The attention of members is drawn to the Committee appointed by the Board of Trade under the chairmanship of Mr. Kenneth Swan, K.C., to consider and report whether any, and if so, what changes are desirable in the Patents and Designs Acts, and in the practice of the Patent Office and the Courts in relation to matters arising therefrom.

The Committee propose, in the first instance, to confine their attention to the subjects to which they have been requested to give early consideration and upon which they have been instructed to furnish an interim report or reports, viz.:

- (a) the initiation, conduct and determination of legal proceedings arising under or out of the Patents and Designs Acts, including the constitution of the appropriate Tribunals; and
- (b) the provision of these Acts for the prevention of the abuse of monopoly rights;

and to suggest any amendments of the statutory provisions, or of procedure thereunder, which in their opinion would facilitate the expeditious settlement and the reduction of the cost of legal proceedings in Patent cases, and would encourage the use of inventions and the progress of industry and trade.

Any member of the Institute who wishes to submit comments on the matters under review, is invited to send his comments to the Acting General Secretary of the Textile Institute, 16, St. Mary's Parsonage, Manchester, 3. A committee of this Institute has been appointed to co-ordinate evidence which is submitted and then forward it to the Patents Committee, 1944. If members wish to submit evidence direct to the latter committee, they should communicate with the Joint Secretaries to the Patents Committee, 1944, The Patent Office, 25, Southampton Buildings, London, W.C.2.

At a later date the Patents Committee will be in a position to give attention to the further matters which fall within their terms of reference. If, however, any member wishes to submit comments on any matters outside the scope outlined above, they are asked to send such comments to the Institute now so that the Institute's Committee can be prepared for later action.

### Diplomas

Elections to Fellowship and Associateship have been completed as follows, since the appearance of the previous list (April issue of the *Journal*):

#### FELLOWSHIP

HAROLD ASHTON,

General Manager, Rayon Staple Development, Courtaulds Ltd., Arrow Mill, Rochdale.

#### ASSOCIATESHIP

PATITPABAN PAL, M.Sc., A.M.C.T., A.R.I.C.,

Lecturer in Dyeing and Head of Textile Chemistry Section, Bengal Textile Institute.

THOMAS ANDERSON,

Chief of Progress, Inspection and Testing, Driver, Hartley & Co. Ltd., Keighley.

## Institute Membership

The following applicants were elected to membership at a recent meeting of Council:

### Ordinary

- Jack Baxter, 29, Ederoyd Grove, Stanningley, Nr. Leeds (Director, Premier Wool Co. Ltd., Milton Mill, Mossley, Nr. Manchester).
- Kenneth Russell Fox, B.Sc.(Eng.), M.Sc.Tech., Textile Division, Massachusetts Institute of Technology, Cambridge 39, Mass., U.S.A. (Assistant Professor, Textile Technology).
- John Norman Grierson, J.P., Messrs. Greenhalgh & Shaw Ltd., Halliwell Mills, Bolton (Managing Director).
- L. B. Hadfield, Messrs. H. Hadfield & Son, Lower House Mill, West Bollington, Nr. Macclesfield (Manufacturing Chemist Proprietor).
- Walter V. Hamburger, B.Sc.(Eng.), M.Sc.Tech., Fabric Research Laboratories Inc., 665, Boylston Street, Boston 16, Mass., U.S.A. (Research Director).
- J. W. Illingworth, B.Sc., M.Sc., Ph.D., F.Inst.P., Textile Division, Fort Dunlop, Erdington, Birmingham (Research Textile Physicist).
- Ernest R. Kaswell, B.Sc.(Chem.), M.Sc.Tech., Fabric Research Laboratories Inc., 665, Boylston Street, Boston 16, Mass., U.S.A. (Associate Research Director).
- James Frederick Levers, "Colwyn," Sunny Grove, Chaddesden, Derby (Textile Designer and Research Worker, Weaving Dept., British Celanese Ltd., Spondon, Derby).
- J. W. J. MacBean, c/o Messrs. Draffen & Jarvie Ltd., Dundee (Director and Merchandise Manager).
- M. C. T. Singhi, Shanti Kunj, 120, Anand Road, Malad, Bombay, India (Carding and Spinning Master, Podar Mills Ltd., Delisle Road, Bombay).
- Seth Swinburne, Messrs. George Tingey & Co. Ltd., 2/4, Beaver Street, Manchester, 1 (Buyer and Producer).
- Frederick Seddon Tinnion, B.Sc.Tech., Messrs. Clark, Son & Morland, Ltd., Glastonbury, Somerset (Works Engineer and Director).
- S. Morley Tonkin, Old Forge House, Hampton Loade, Nr. Bridgnorth (Managing Editor, *Cordage, Canvas and Jute World*).
- Gordon Roland Wyon, 24, Edward Street, Oldham (Company Director and Sales Manager, British Depa Crêpes Ltd., Glebe Mills, Hollinwood, Lancs.).

## Employment Register

The following announcement is taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:

- No. 236—Associate, desires position as Assistant Manager or Inside Manager in Cotton Spinning Mill. Age 42 years. Knowledge of weaving, knitting and finishing processes. Good experience of modern spinning machinery. Sixteen years' experience as head spinning overlooker. Excellent references. Accustomed to handling labour.

## Vacancy

DYEHOUSE CHEMIST required by firm of cotton, rayon and wool yarn dyers of moderate size in Manchester area, who intend to develop these activities after the war. Opportunity for man with initiative possessing appropriate scientific qualifications and experience to build up modern laboratory controlling dyehouse operations. Reply stating age with full details and salary required.—Box No. 68.

## INSTITUTE MEETINGS

### LANCASHIRE SECTION\*

Friday, 14th July—*Manchester*. 1.0 p.m.—Lunch-time meeting at the Institute's premises. "Preparation of Yarns for Weaving," by G. Harris, F.T.I.

# THE JOURNAL OF THE TEXTILE INSTITUTE

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## PROCEEDINGS

### Lancashire Section

#### COSTING FOR THE TEXTILE INDUSTRY

By H. M. BROADLEY\*

*Paper delivered to the Lancashire Section, 29th February, 1944*

#### FOREWORD

The system of Textile Costing which is described in this paper, is based on "Standard Costing," or the determination of the cost of standard products, produced in standard quantities under standard conditions, which may be normal or otherwise.

During recent years the British textile industry has been subjected to statutory price control and prescribed process rates which has had the effect of unification of particular prices for each section of the Industry. The introduction of these price control orders has made textile executives more cost minded than has been the case in the past, and there is now apparent a general desire to know more about the science of actual cost finding as a means of comparing accurate individual mill costs with market or statutory prices.

Costs form the foundation for building comparative statistical data that would prove of real value to the Textile Industry, particularly as an accurate guide to uniform price fixing provided of course that uniform methods of arriving at costs are first introduced, and efficiency achieved.

Economics of industry must be applied now in order that we may expand in the future and compete in world's markets at a world's price.

Costing is based on three main items which are common to all industries, and may be briefly defined as Wages, Materials, and Overhead Charges.

The next stage in costing deals with the proper apportionment of these three items of expenditure, comprising the collection of costs for every order, job, service or unit, so that correct data may be available for the efficient control of the respective undertakings.

The co-operation of all concerned with production is required in order to reap the maximum benefits arising from modern costing. Co-operation of necessity requires knowledge of all relevant detail. Managers, assistants, and foremen should be made aware of their costs, encouraged to make suggestions, and to inaugurate more efficient and economical production methods.

\* Mr. H. M. Broadley, F.C.W.A., is the cost accountant at Messrs. Richard Haworth & Co. Ltd., Salford.

Scientific progress in the textile industry can only express itself as a practical aid to the industry through the voice and terminology of cost accounting. The enthusiastic textile technologists, together with the textile engineers need the guidance of the acid test of cost accountancy, otherwise it is not known if new schemes are good or bad.

The Budget examples and Cost Tables which are included in this paper refer to a spinning and manufacturing company equipped with the following machinery, which is listed in Table II :

Carding Engines	...	...	...	200
Drawing Frames	...	...	...	14 Preparations.
Cardroom Speed Frames	...	...	...	As listed
Ring Spinning	...	...	...	100,000 Spindles
Weaving	...	...	...	1,000 Looms.

### The Objects and Problems of Installing a Cost System

What are the objects and problems of installing an exact cost system at your particular mills? These may be briefly defined as follows:—

#### *Objects :*

- (1) To measure progress and indicate the most economic productions.
- (2) To indicate the efficiency of machine and process output at every stage.
- (3) To provide the management with an indication of the progress of work in process, and reveal by resultant statistics the source of abnormal waste, inefficiency and leakage.
- (4) To indicate where future savings or cost reductions may be made by the use of weekly charts of cost and output values, expressed in terms of standard wages and expenses, which is a unit measure of process efficiency expressed in sterling.
- (5) To establish correct costs at each Mill, so that comparison of costs with other units within the same group may be made.

#### *The Problems of installing a cost system are briefly :—*

- (1) The accurate allocation of all overhead charges, direct and indirect wages to each process. It is essential that the total cost for both wages and expenses be ascertained for each process, whether such process is productive or merely changing the form of package.
- (2) Defining the departmental functions or process groups, giving a clear definition of each, and the setting up of output target figures.
- (3) Preparation of uniform schedules of headings for the analysis of expenditure, and a description of what is to be included under each expense heading.
- (4) Instituting systems of weekly returns which are necessary to compare actual production with the target calculated for each unit.
- (5) The need for some practical industrial training on the part of the accountant responsible for installing the system.
- (6) The linking up by budgetary control the cost accounts with the final trading accounts.

All costs must be segregated, and the following method is recommended :—

### Purchases Inwards for Entry in Loose Leaf Analysis Books

- (1) Direct Material Costs. This refers to raw materials for use in subsequent process, e.g., raw cotton, yarn, rayon, material chargeable to a particular job.
- (2) Prime Costs. Size material, healds, reeds.
- (3) Factory Expenses. Power, rents, rates, insurance, departmental repairs and consumable stores analysed in a uniform order as determined by uniform definition.
- (4) Sales, Administration and Transport. This is self explanatory and refers to the expenses of sales, publicity and administration.



Each of these trading accounts must be broken down to disclose at a glance the purchase totals of each separate item of expense included in the Budget. Analysis accounts might be printed on wide columnar sheets with the headings of uniform trading accounts entered at the top. The analysis books should be ruled off and balanced monthly, and stock values recorded.

### The Gross Payroll must be analysed weekly to each process

- (1) *Direct Wages.* Wages incurred in the actual conversion process. These are generally piece-rate workers, e.g., cotton weavers, cardroom operatives, spinners, etc. Direct workers include those paid datal or hourly rate, plus production piece rate or any other combination of incentive rates.
- (2) *Indirect Wages.* This refers to wages paid to ancillary workers who are not directly handling the process production, but are essential to the efficient working of process employees. For example, cleaners, oilers, sweepers, truckers, supervisors, hoistmen, bobbin carriers, weft men, etc.
- (3) *National Insurance.* The employers weekly contribution must be allocated to each process.

Sales must also be analysed to provide suitable statistics, including details of credits for waste, scrap metal, cloth fents, etc.

It will be an advantage if the quantities in lbs. or pieces, etc., are included in the various analysis accounts in addition to sterling values.

The nominal ledger should be in the same progressive sequence as the purchase and sales analysis books, and the same sequence carried forward to the budget. This scheme simplifies the systematic posting of ledgers in practice.

### The Cost Budget (Table I)

The budget of overhead expenses for any year under review is extracted, partly from Average Trading Account figures as disclosed by the Nominal Ledger, and partly from actual adjustment based on present-day knowledge of the trend of prices or costs.

The active machine hours must be carefully noted for each process each year, and stores adjustments made for any idle plant.

The cost budget is headed, and sub-divided to the following cost accounts.

Ref. 1. Spinning and Weaving.	}	Process cost accounts for transfer to Table II.
Ref. 2. Power Account		
Ref. 3. Maintenance		
Ref 4 Transport ... ..		For final inclusion in final costs schedule at a flat rate per lb.
Ref. 5. Sales & Administration ...		For inclusion in final costs schedule as a percentage of overhead rate.
Ref. 6. Direct Charges ... ..		To be charged directly to the particular cost job.

The Budget figures do not refer to any particular company and are merely used for purposes of illustration.

### The Distribution of Overhead Charges

After the Budget is compiled the distribution of overhead charges for the ascertainment of process rates must be assessed and this is demonstrated in Table II. The procedure adopted to distribute the Budget to each productive department or process is explained. The basis of the allocation for each account is stated, and the process departments are indexed by progressive numbers 6 to 18. At the foot of this account the yearly rates are expressed as total sterling overhead rates per week. Also the separate rates for each production unit are

calculated. These rates are known as machine hour rates, and for costing purposes they are expressed in pence. The only information excluded at this stage are the direct piece-work wages, and machine output per unit hour.

This method of setting out the overheads is found very useful in actual practice, the whole picture is seen at a glance, and the information contained, expressed in sterling, is easily understood without the necessity for further reference to financial figures.

It will be noted that the operating machinery is also listed for the purpose of fixing machine rates.

Having now prepared a detailed breakdown of the overhead expenses there is ample scope for cost investigation under any conditions of production. Such items as idle plant loss expressed in sterling may now be tabulated, also reductions in costs per unit of output effected by cutting out any unnecessary process. Any other practical changes for increasing efficiency are readily costed and compared.

Idle plant loss, is tabulated each week, and posted to a separate account for each department. This account brings to the notice of the management the weekly cost of idle plant expressed in sterling.

#### Loom Rate per hour (Table III)

For mixed weaving sheds it will be necessary to ascertain the rate per loom/hour for each type or group of looms. Such items as loom area, looms per over-looker, loom horse-power, etc., for each group, must be known. Each group of looms must be regarded as a separate department, or process, and must be allocated the true share of the actual costs incurred in their maintenance.

For example, it would not be correct to charge a proportion of the expense of Jacquard harness or depreciation to plain looms.

In mixed weaving sheds it is not correct to estimate the overhead expenses as a percentage of the weaving wage, loom hour rates and loom time must be the basis of actual production cost.

#### The Weaving Cost (Table VII)

This is a practical example of the costing of a Jacquard Casement fabric. The assembly of cost rates for several processes, e.g., winding, beaming, have been excluded, the principle employed is the same as that described in spinning.

The cost schedule includes every item of cost actually incurred in the production of this particular fabric when woven in a 45 in. Jacquard loom. Each process is tabulated in the order of actual production sequence which is common to the industry. Full details of costs are stated, and the method of calculating the rates and quantities is given in the examples.

Complete costings entered on printed cost cards for every cloth sort produced, can be filed progressively by cloth sort number for quick reference. The reverse side of each card being printed to show at a glance the progressive orders, margins, and cost variations.

The cost cards so used are a complete history reference for future guidance, and production control.

#### The Summary of the Costs per yard of the Casement Fabric. Including Spinning of the Yarn and Weaving of the Loom State Fabric

Cost Item				d.	%
				per yard	of total
All labour	...	...	...	2.021	22.6
Overhead	...	...	...	1.782	19.8
Materials	...	...	...	5.153	57.6
				<hr/> 8.956	<hr/> 100.0

**Distribution of the Costs for Sales and Administration**

The cost rate for sales and administration is expressed as a percentage of the overhead expenses, which are calculated at an hourly rate. This method is more exact than that of relating the costs to direct spinning or weaving wages.

The cost of transport is charged at a flat rate per pound of cloth, this account refers to local transport; alternatively it may be necessary to charge a weight-mileage rate.

					Spinning	Weaving
Sales and Administration	...	...	£4,956		2,110	2,846
Transport	...	...	2,511		—	2,511
			<u>£7,467</u>		<u>2,110</u>	<u>5,357</u>

			Spinning Room	Weaving Room	Total
Budget Reference No.	...	...	12	17	—
Budget Amount	...	...	£33,556	£27,861	£61,417
(5) Sales and Administration	...	...	2,110	2,846	4,956
Percentage of Budget	...	...	6.2%	10.2%	8.1%
(4) Transport—Cloth	...	...	£2,511		
lbs. of cloth woven, 4,900,000 = 12d. per lb. flat rate.					

**Summary Chart of Cost Elements**

The three main elements are now analysed and arranged in the following order :—

(1) Direct Labour	} = Prime Cost	} Factory Cost	} = Total cost.	} = Selling Price.			
Direct Materials							
Direct Expenses							
(2) Indirect Labour							
Indirect Materials							
Other Indirect Factory Expenses							
(3) Sales and Administration Expenses							
Transport Expenses							
(4) Margin on Total Cost							
Profit +							
Loss -							

**Cost Control Demonstrated by the Use of Charts and Graphs, revealing Marginal Costs and Trend at a Glance**

All costs are expressed in sterling and are readily understood in the works and elsewhere.

The spinning costs, Fig. 1, are expressed in pence per pound of output, and reveal the more costly of the spinning processes where the greatest savings may be made.

The total and departmental cost control charts, Fig. 2, express efficiency in pounds sterling. The various Departments may be sub-divided into processes, e.g., Weaving - Sizing, Looming, Weave Room, Cloth Room.

The total production value (P.V.) is the weekly output of all products extended at the respective standard costs expressed in terms of wages and expenses.

The total cost is the gross total of the payroll plus the overhead expenses per week.

Table Budget of Overhead Expenses

Prog. No.	Ledger No.	Trading Account	Basis of Allocation	Budget P.A.	Reference No.						Prog. No.
					1	2	3	4	5		
					Cost Department.						
					Spinning and weaving	Power account	Main-tenance	Transport	Sales and Administration	Direct charges	
1	10	Rent and rates ... ..	Area ... ..	£ 1,200	£ 1,100	£ 40	£ 20	£ 25	£ 15	£	1
2	14	Insurance ... ..	Actual ... ..	1,800	1,279	200	16	105	...	...	2
3	18	Federation levies ... ..	Spindle equivalent ... ..	600	600	...	...	...	...	...	3
4	22	Salaries ... ..	Actual analysis ... ..	6,500	3,500	500	1,000	100	1,400	...	4
5	28	Indirect wages ... ..	Payroll analysis ... ..	45,400	40,000	...	1,200	1,200	3,000	...	5
6	30	Maintenance ... ..	...	4,000	...	...	4,000	...	...	...	6
7	34	Depreciation ... ..	Machinery value ... ..	10,000	8,400	1,200	60	240	100	...	7
8	38	National insurance ... ..	Payroll analysis ... ..	4,100	3,800	24	120	30	126	...	8
9	42	Coal, power and steam ... ..	Power account. H.P. lbs ... ..	8,000	...	8,000	...	...	...	...	9
10	46	Gas ... ..	Area for lighting ... ..	20	...	20	...	...	...	...	10
11	50	Electricity power and light ... ..	Area for lighting ... ..	9,000	1,200	7,800	...	...	...	...	11
12	54	Water ... ..	Power account ... ..	200	...	200	...	...	...	...	12
13	58	Bobbins ... ..	Spinning and weaving ... ..	1,500	500	...	...	...	...	...	13
14	62	Brushes ... ..	Spinning account ... ..	400	1,400	...	...	...	...	...	14
15	66	Card clothing ... ..	Spinning account ... ..	1,000	1,000	...	...	...	...	...	15
16	70	Card cans ... ..	Spinning account ... ..	250	250	...	...	...	...	...	16
17	74	Roller skins and cloth ... ..	Spinning account ... ..	700	700	...	...	...	...	...	17
18	78	Repairs, spinning ... ..	Spinning account ... ..	2,200	2,200	...	...	...	...	...	18
19	82	Stores spinning ... ..	Spinning account ... ..	500	500	...	...	...	...	...	19
20	86	Heads and reeds ... ..	Direct charges ... ..	1,500	...	...	...	...	...	...	20
21	90	Sizing ... ..	Direct charges ... ..	6,000	...	...	...	...	...	1,500	21
22	100	Shuttles ... ..	Weaving account ... ..	600	600	...	...	...	...	...	22
23	104	Loom cord ... ..	Weaving account ... ..	150	150	...	...	...	...	...	23
24	108	Pickers ... ..	Weaving account ... ..	200	200	...	...	...	...	...	24
25	112	Picking bands ... ..	Weaving account ... ..	250	250	...	...	...	...	...	25
26	116	Skips ... ..	Weaving account ... ..	300	300	...	...	...	...	...	26
27	120	Wet tins ... ..	Weaving account ... ..	100	100	...	...	...	...	...	27
28	124	Repairs, weaving ... ..	Weaving account ... ..	2,500	2,500	...	...	...	...	...	28
29	130	Jacquard harness ... ..	Jacquard account ... ..	1,000	...	...	...	...	...	...	29
30	134	Jacquard cards and designs ... ..	Direct charge ... ..	200	...	...	...	...	...	1,000	30
31	138	Leather and laces ... ..	Spinning and weaving ... ..	900	870	20	10	...	...	...	31
32	142	Oil and tallow ... ..	Spinning and weaving ... ..	1,050	950	80	20	...	...	...	32
33	146	Paper ... ..	Spinning and weaving ... ..	200	200	...	...	...	...	...	33
34	150	Sponge cloth ... ..	Spinning and weaving ... ..	300	280	5	15	...	...	...	34
35	154	Sundries ... ..	Spinning and weaving ... ..	800	450	20	30	...	300	...	35
36	160	Repairs, buildings ... ..	Area ... ..	700	630	30	15	10	15	...	36
37	164	Repairs, lighting ... ..	Area ... ..	300	290	5	4	1	...	...	37
38	168	Repairs, power ... ..	Horse power ... ..	700	...	700	...	...	...	...	38
39	176	Motor transport ... ..	Transport ... ..	800	...	...	...	800	...	...	39
40	180	General carriage ... ..	Transport ... ..	1,200	400	...	...	...	...	800	40
				116,920	74,589	18,844	6,510	2,511	4,958	9,500	
					99,953						

Table II. Distribution of Overhead Expenses

Prog. No.	Ledger No.	Trading Account	Basis of Allocation	Budget P.A.	6	7	8	9	10	11	12	13	14	15	16	17	18	Prog. No.
					Cotton open and clean	Carding	Drawing	Spinning	Lint	Rowing	Ring Spinning	Winding	Warping	Sizing	Looming	Weaving	Cloth Room	
1	10	Rent and rates	Area of each process	1,100	69	115	19	20		78	314	99	35	23	4	274	18	1
2	14	Insurance	Per Insurance Policies	1,279	105	92	38	19		60	342	80	20	50	2	371	70	2
3	18	Federation levies	Spindle equivalent	600	...	...	...	...		...	490	36	6	...	...	98	...	3
4	22	Salaries	Payroll analysis	3,500	43	116	58	52		145	710	356	90	4	9	1,427	414	4
5	26	Indirect wages and holiday pay	Payroll analysis	40,000	2,800	5,000	320	600		1,400	14,000	600	300	1,800	300	8,880	3,500	5
7	34	Depreciation	Machinery value	8,400	485	745	174	174		288	3,110	157	39	298	124	2,484	24	7
8	38	National insurance	Payroll analysis	3,800	57	152	76	68		190	1,520	152	45	19	38	1,328	57	8
11	50	Electricity and light	No. of lights	1,200	42	72	30	25		54	545	18	24	12	12	318	18	11
13	53	Bobbins	Stores analysis	1,300	...	...	...	70		200	800	160	30	...	...	140	...	13
14	62	Erases	Stores analysis	400	25	40	7	7		28	114	35	13	9	3	100	7	14
15	66	Card clothing	Spinning (carding)	1,000	...	1,000	...	...		...	...	...	...	...	...	...	...	15
16	70	Card teas	Spinning (carding)	250	...	120	130	...		...	...	...	...	...	...	...	...	16
17	74	Roller skins and cloth	Stores analysis	700	...	...	30	52		165	440	...	...	...	...	...	...	17
18	78	Repairs, spinning	Expenditure analysis	2,200	190	400	60	70		100	1,160	100	40	...	...	...	...	18
19	82	Stores, spinning	Stores analysis	500	40	70	15	20		25	286	25	20	...	...	...	...	19
22	100	Shuttles	Weave room	600	...	...	...	...		...	...	...	...	...	...	600	...	22
23	104	Loom cord	Weave room	150	...	...	...	...		...	...	...	...	...	...	150	...	23
24	108	Pickers	Weave room	200	...	...	...	...		...	...	...	...	...	...	200	...	24
25	112	Picking bands	Weave room	250	...	...	...	...		...	...	...	...	...	...	250	...	25
26	116	Skins	Weave room	300	...	...	...	...		...	200	...	...	...	...	100	...	26
27	120	Wet tins	Weave room	100	...	...	...	...		...	...	...	...	...	...	100	...	27
28	124	Repairs, weaving	Expenditure analysis	2,300	...	...	...	...		...	...	...	...	200	80	2,200	20	28
31	138	Leather and laces	Stores analysis	870	60	120	20	30		40	300	12	3	10	...	220	10	31
32	142	Oil and talow	Stores analysis	950	30	50	22	30		100	265	9	9	20	10	375	...	32
33	146	Paper	Stores analysis	200	3	8	4	3		10	80	8	2	1	2	71	3	33
34	150	Sponge cloth	Stores analysis	280	4	11	5	5		13	115	11	3	2	2	98	4	34
35	154	Sundries	Stores analysis	450	7	19	9	8		23	165	19	5	3	4	169	7	35
160	Repairs, buildings	Area and expenditure	680	40	67	11	12			43	176	57	20	13	2	158	12	36
164	Repairs, lighting	Area and expenditure	280	10	17	7	6			14	133	4	6	3	8	76	4	37
180	General carriage	Expenditure analysis	400	30	40	10	20			40	70	30	...	20	10	60	40	40
Transfer	Power account	Horse power	18,644	1,470	1,888	288	312			1,123	6,469	202	112	1,283	14	4,991	28	42
"	Maintenance	Area	6,510	410	691	118	121			449	1,842	591	210	134	26	1,613	105	43
TOTAL OVERHEAD EXPENSES				39,953	5,830	10,943	1,444	1,724	2	4,824	33,556	2,731	1,032	3,914	645	26,881	4,841	
Process rate per week (494 weeks)				2,019	120	221	28	35		91	678	55	21	79	13	543	97	
Process Production Units. Machinery					200 cards	14 Preps. each 8 days.	1,400 Spindles 14 Frames	3,200 Spindles 28 Frames		8,000 Spindles 48 Frames	100,000 Spindles 250 Frames	3,000 Spindles 16 Frames	3 Frames	2 Frames	1,000 Looms	4 Machines		
Machine Rate per week in Pence.					266 per Card	62 per Delivery	600 per 100 Spindles	per Spindle		242 per 100 Spindles	163 per 100 Spindles	440 per 100 Spindles	316 per Frame	...	...	130 per Loom	...	

Fig. 1. CARDING AND SPINNING. PROCESS FLOW COST CHART  
Wages and Expenses per lb. of yarn.

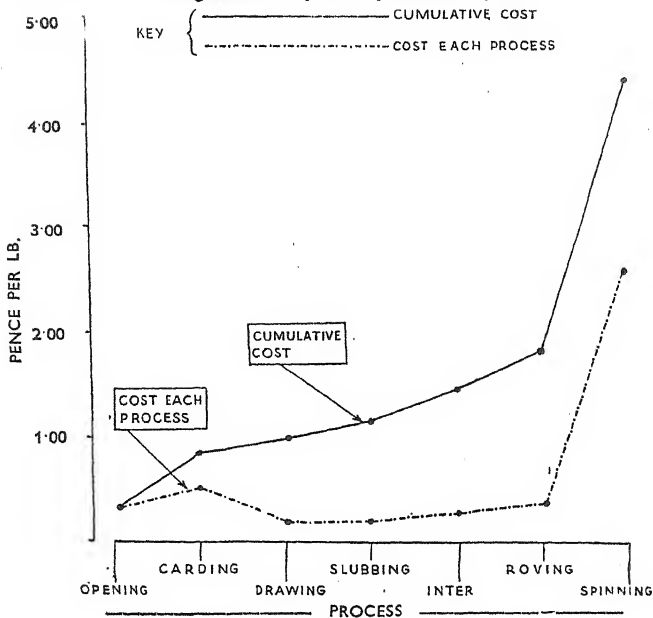
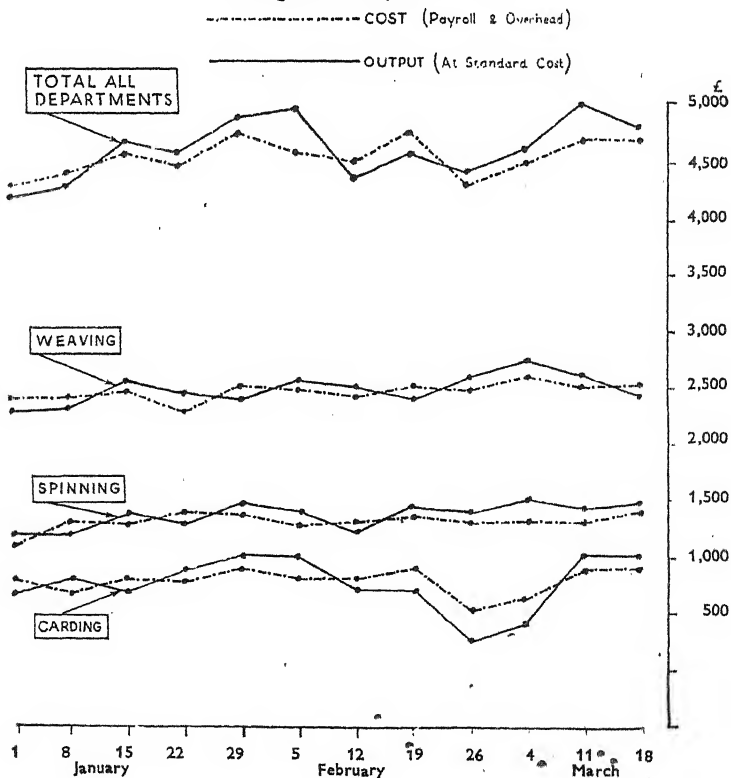


Fig. 2. RECONCILIATION AND COST CONTROL. WEEKLY COST BALANCE CHART  
Wages and Expenses



## Process Costing, Carding and Spinning

The Tabular statement of process costs shown in Tables IV and V, is intended to demonstrate the principle which is used to ascertain the costs of wages and expenses per pound of output at each stage of the process. In practice tables are prepared to show the cost at a glance of every count and quality of yarn spun. Actual output and costs are compared with standard costs for each process weekly.

Table VI. This illustrates the process cost of cotton (including loss) at each stage, and the actual material transfer price after making due allowance for regain (on waste) made at each process. The same principle of costing may be applied to Cotton Doubling.

Table III  
Loom Rates per Hour

Prog. No.	Trading Account.	Basis of Allocation	Total P.A.	Description of Looms in a Mixed Shed			
				40 in. Plain	45 in. Dobby	45 in. Jacquard	60 in. Jacquard
Ref. 17		Looms ...	1,000	400	200	200	200
			£				
1	Rents and rates	Loom area ...	274	95	53	53	73
2	Insurance	Value of looms ...	371	82	62	103	124
3	Federation levy	Loom reed space ...	98	34	19	19	26
4	Salaries	Actual and R.S. ...	1,427	495	280	290	362
5	Indirect wages	Looms per Tackler, etc. ...	8,880	2,440	1,350	2,025	3,065
7	Depreciation	Loom value ...	2,494	555	415	692	832
8	National Insurance	Payroll analysis ...	1,328	472	236	296	324
11	Electricity	No. of lights ...	318	114	57	71	76
13	Bobbins	Stores analysis ...	140	314	182	228	266
14	Brushes	" ...	100				
22	Shuttles	" ...	600				
23	Loom cord	" ...	150	222	127	136	165
24	Pickers	Loom reed space ...	200				
25	Picking bands	" ...	250				
26	Skips	" ...	100				
27	Weft tins	" ...	100	780	410	487	523
28	Repairs, weaving	Actual ...	2,200				
31	Leather and laces	Reed space ...	220				
32	Oil and tallow	" ...	375				
33	Paper	" ...	71	324	182	190	237
34	Sponge cloth	" ...	98				
35	Sundries	" ...	169				
36	Repairs, buildings	Loom area ...	158	54	31	31	42
37	Repairs, lighting ...	No. of lights ...	76	26	14	17	19
40	General carriage	Loom reed space ...	60	21	11	12	16
42	Power account	Actual H.P. ...	4,991	1,720	941	1,030	1,300
43	Maintenance	Loom area ...	1,613	560	316	320	417
		TOTAL ...	26,861	8,308	4,686	6,000	7,867
Ref. 6	Jacquard harness	Jacquards, actual ...	1,000	—	—	428	572
		TOTAL FOR YEAR	£ 27,861	8,308	4,686	6,428	8,439
	Rate per week (49½ weeks) ...	£ 563	168	94	130	171	
	Loom rate per week in pence ...	—	101	113	156	205	
	Loom rate per hour (47½) in pence ...	—	2.12	2.38	3.28	4.32	

Table IV  
Process Costing—Carding and Spinning  
(Expenses as per Budget Table II. Process output based on net spinning output, including waste allowance).

Ref.	Budget Process	Cost unit	Prod. per unit	Ct.	Wages per unit	Expenses per unit	Cost per lb. wages	Cost per lb. expenses	Total cost per lb.
			lbs.						d.
6	Open and clean	Dept.	100,000	—	£50	£70	·120	·168	·288
7	Carding	One card	500	—	d. 100	d. 166 (266d.)	·200	·332	·532
8	Drawing	One Delivery	893	·123	94	62	·105	·069	·174
9	Slubbing	100 Spindles	7,140	·500	620	600	·087	·084	·171
10	Inter.	100 Spindles	3,125	1·20	470	352	·150	·112	·262
11	Roving	100 Spindles	1,110	3·00	190	242	·171	·218	·389
12	Ring spinning	100 Spindles	100	32·00	96	163	·960	1·630	2·590
							1·793	2·613	4·406

The costing of any process for any particular hank, count or quality is ascertained according to actual or target output per unit of production, e.g. :—

$$\frac{\text{Expenses per unit/week}}{\text{Actual output per unit week.}} + \text{Wages cost or piece rate per lb.} = \text{Total cost per lb.}$$

Table V  
Analysis of Waste Loss—Progress from Raw Cotton to Yarn

Ref.	Mixing	No. 1 American lbs.	Constants	
	Raw cotton ...	1·000	1·000	
6	Scutcher lap ...	·957	1·045	
7	Card sliver ...	·890	1·123	
8	Drawing ...	·889	1·125	
9	Slubbing ...	·888	1·126	
10	Inter. ...	·887	1·127	
11	Roving ...	·886	1·128	
12	Yarn spun ...	·876	1·141	
	Cotton constant ...	1·141	$\frac{1,000}{876}$	= Constant 1·141 or 114·10 lbs. of raw cotton is required to produce 100 lbs. of cotton yarn.
	Waste regain ...	·200d.		
	Raw cotton cost ...	7·390d.		
	Add Basis ...	·910		
		8·300		
	Carriage ...	·120		
	Levy ...	·050		
	Commission 1% ...	·041		
		8·511	$\times 1·141 =$	d. 9·711 Clean cotton.
	Spinning cost. 32s T. (Fig. 4) ...		$= 4·406$	d. 8·511 Raw cotton.
				14·117
	Less regain ...			·200
	Cost on ring bobbin ...			13·917
	Add Sales, Administration ...			·100



**Table VI**  
**Total Process Costs and Waste Losses—Carding and Spinning**

Budget Ref.	Raw cotton @ 8·511d.	Count	Constants (see Table V)	Cotton loss	Process wages and expenses	Total	Less regain	Total cost	Total cost including cotton
6	Open and cleaning ...	—	1·045	·383	·288	·671	·070	·601	9·112
7	Carding ...	—	1·123	·664	·532	1·196	·090	1·106	10·218
8	Drawing ...	·123	1·125	·016	·174	·190	·010	·180	10·398
9	Slubbing ...	·500	1·126	·009	·171	·180	·005	·175	10·573
10	Inter. ...	1·200	1·127	·008	·262	·270	·003	·267	10·840
11	Roving ...	3·00	1·128	·009	·389	·398	·002	·396	11·236
12	Ring spinning	32·00	1·141	·111	2·590	2·701	·020	2·681	13·917
				1·200	4·406	5·606	·200	5·406	

**Table VII**  
**The Weaving Cost**  
**Cloth Costing for a Casement Fabric**

Woven in a 45 in. Reed Space Jacquard Loom

Construction :	Cloth width	length	Ends per inch	Picks per inch	Warp	Weft
	37 ins.	100 yds.	79·5	47	32s American 200s Denier rayon	16s American

(1) MATERIAL COST.

					Cost per 100 yards d.
(a) Warp.	5·84 lbs.	32s American	@ 14·01	(Ref. Table V)	81·81
	6·61	200 Denier	@ 53·00		350·33
	·26	Selvedge 2/40	@ 27·00		7·02
	·15	Warp waste on	6·10 lbs.		2·22
	<u>12·86</u>				<u>441·38</u>
(b) Weft.	13·44 lbs.	16s American	@ 13·50		181·44
	·67	Waste	@ 13·50		9·07
	<u>14·11</u>				<u>190·51</u>
					<u>631·89</u>

(2) WEAVING PROCESS COSTS :

Ref. 3	Winding	5·84 lbs.	@ 1·14		6·66
4	Beaming	5·84	„ @ .49		2·86
5	Sizing		@ .30	Material	
			@ .90	Overhead	7·01
6	Looming	2,920 ends	× 36d.		
		15 cuts	× 1,000		7·00
7	Cards.	8 in. design.	250 cuts		10·80
8	Clothroom				25·00
9	Weavers' Wages :		d.		
	(a) List Price (Uniform List)	99·00	+4%		116·63
	(b) Hourly rate. 23·4 × 2·45	= 13·15			
		<u>4</u>			
10	Weaving Expenses.	23·4 hrs.	@ 3·28 (Table III)		76·75
11	Sales, Administration and Transport.				
	S. & A. 10·2% × 76·75		= 7·83		
	Transport 26·15 lbs. @ .12		= 3·26		
					<u>11·09</u>
					<u>263·80</u>

COST PER 100 YARDS = 895·69  
COST PER YARD = 8·9569

### Calculation of Material Quantities per 100 yards of Grey Cloth

(a) COTTON WARP.

$$\frac{1,440 \text{ ends} \times 109 \text{ tape length}}{32 \text{ counts} \times 840 \text{ yards}} = 5.84 \text{ lbs.}$$

RAYON WARP.

$$\frac{1,440 \text{ ends} \times 102.5 \text{ tape length} \times 200 \text{ denier}}{840 \text{ yards} \times 5,314 \text{ constant}} = 6.61 \text{ lbs.}$$

SELVEDGE.

$$\frac{40 \text{ ends} \times 109 \text{ tape length}}{2/40 \text{ counts} \times 840 \text{ yards}} = .26 \text{ lbs.}$$

(b) WEFT.

$$\text{Cloth reed space. } \frac{2,920 \text{ ends}}{76 \text{ reed}} = 38.42 \text{ inches.}$$

$$\frac{38.42 \text{ in.} \times 47 \text{ pick} \times 100 \text{ yards}}{16 \text{ counts} \times 840 \text{ yards}} = 13.44 \text{ lbs.}$$

Ref. 9, 10.

Weaving time @ 75% efficiency.

$$\frac{47 \text{ picks} \times 100 \text{ yards} \times 36 \times 100}{60 \text{ mins.} \times 160 \text{ p.p.m.} \times 75} = 23.40 \text{ hours (including gaiting).}$$

Summary: WEAVING CONVERSION COST (Production Value)  
per 100 yards.

	d.	%
Weaving piece rate—Uniform List	= 99.00	= 37.50
Other weaving department wages and expenses cost	= 155.28	= 58.80
Winding and beaming cost	= 9.52	= 3.70
Production value	<u>263.80</u>	<u>100.00</u>

## Review

### THE MCNAIR REPORT ON THE TRAINING OF TEACHERS

This Report, recently published by the Board of Education (Teachers and Youth Leaders, H.M. Stationery Office, price two shillings net), is the work of a Committee appointed in 1942 by the President of the Board to advise upon the principles which should guide the Board in future with regard to the supply, the methods of recruitment and the training of teachers and youth leaders. The Chairman of the Committee was Sir Arnold McNair, Vice-Chancellor of Liverpool University, and the interests of technical education and industry were ably represented by Dr. A. P. M. Fleming, Director of Metropolitan-Vickers Electrical Co., Ltd. The Textile Institute and several of its members were amongst those who gave evidence.

In order to put into effect the vast educational programme foreshadowed in the Education Bill, it is estimated that between 50,000 and 90,000 teachers, in addition to 200,000 employed in 1938, will be required, with an estimated wastage, to be replenished, of about 15,000 a year. The recruitment and the training of this great army present stupendous problems, which the Report faces squarely and attempts boldly to solve. It shows clearly that "the existing arrangements for the recognition, the training and the supply of teachers are chaotic and ill-adjusted even to present needs" (par. 58) and that "nothing but drastic reforms involving the expenditure of considerable additional sums of public money will secure what the schools need and what children and young people deserve" (par. 12).

To readers of the *Journal of the Textile Institute*, Part III is the most important section of the Report. It is so important, indeed, that no one interested in technical education, whether from the educational or the industrial point of view, can afford to neglect it. With breadth of vision, clear analysis, strength of statement and sound deduction it puts the case for technical education and technical teachers more cogently than it has ever been put before in an official document.

The keynote is struck in the Introduction: "Technical education in this country has never received the attention it deserves" (par. 381); "The good technical teacher is no mere technician, he is also an interpreter of the modern

world " (par. 382); " Technical teachers, regarded collectively, constitute a key group in industrial development " (par. 384). The Report then proceeds to discuss in detail the present position and the future needs of technical education and technical teachers and points out many improvements necessary to attract teachers of good quality and to enable them to serve efficiently.

A valuable section of the Report deals with the ever-present problem of the co-operation of industry and commerce with technical education. Important suggestions are made, the most novel of which is " that the Board of Education should invite suitable Professional Institutions to establish standing committees whose duty it would be to promote co-operation between industry and commerce and the technical and commercial colleges, with particular regard to enabling teachers by means of periodic returns to industry and commerce to keep abreast of their subjects " (par. 434). The Textile Institute is not in the list of examples of such institutions though it might well have been included.

It is true, as the Committee say, that " the planning of suitable courses of professional training for technical teachers is no simple matter " (par. 437), but they give a very attractive first sketch in the paragraphs (439-444) dealing with the nature of training courses. They conclude, however, that " the right kind of training, its nature and length, can be worked out only as the result of systematic experiment throughout the whole country " (par. 444), and they recommend that " each area training authority should include representatives of technical and commercial education and should appoint a director of technical training to organise courses of training and to promote systematic enquiry into the problems of training technical teachers " (par. 445). This recommendation is so far in advance of previous thought on the subject that it is startling, though welcome.

The Chapter on Salaries (pars. 446-452) will be regarded by some as revolutionary, but by those who know intimately the work and qualifications of the staffs of technical colleges it will be accepted as just. It is reasonable that " the salaries of teachers in technical colleges should be related to the emoluments obtainable by persons of similar qualifications and experience in industry and commerce, in the Services and in Government departments " and that " the salaries of the Heads of the most important departments should be on the professorial level " (par. 452).

It is good to observe how insistent the Report is on the adoption, throughout the teaching service, of the principle of secondment. This principle is even more important to technical teachers than to others because, for efficiency, they must keep in touch with developments in industry and commerce at home and abroad as well as with the progress of educational thought and practice.

The observations on " Young People's Colleges " (pars. 373-380) are provocative of thought, and, perhaps, of some dissent, but they are worthy of careful consideration.

In the other parts of the Report, dealing with Primary and Secondary Schools, the Youth Service and " other important matters," there is much of general interest. If the recommendations are adopted, chaos will be reduced to order, the teaching service will be unified, new avenues of recruitment will be opened even for persons of mature age and the " standing of education " will be improved. The supervision of the training of teachers of all kinds will be the duty of a Central Training Council and the administration that of fully representative Area Authorities. Conditions of service (including salaries) will be improved and there will be only one grade of teacher, the qualified teacher, recognised by the Board.

The Report ends with a significant paragraph (526): " There is one non-material factor which is vital to the greater effectiveness of the teaching profession. England—we do not say England and Wales—has never attached enough importance to education and has therefore never given to the teaching profession the esteem that it needs and deserves. Only if the country experiences a change of heart will teachers receive that degree of respect that is needed to secure for our children their fair share of the services of the very best of our fellow citizens."

J. E. DALTON.

### Additions to the Library

The following publications have been received in the Library :—

"Technique of Dyeing Rayons." H. A. Thomas. Emmott & Co., Limited, Manchester. Price, 2/6.

"Principles of Dress Design." William H. Hulme. The Maker-Up, London. Price, 5/-.

### Institute Diplomas

Elections to Fellowship and Associateship have been completed as follows, since the appearance of the previous list (June issue of the *Journal*):

#### FELOWSHIP

JOHN BOULTON, M.Sc.Tech., A.M.C.T.,

Research Chemist, Textile Research Laboratories, Courtaulds Ltd., Bocking.

JOSEPH NOGUERA,

Technical Manager and Director, Casablanca High Draft Co. Ltd., Salford.

CHARLES SMALLEY WHEWELL, M.Sc.(Hons.), Ph.D.,

Lecturer in Cloth Finishing, Leeds University.

#### ASSOCIATESHIP

OSWALD GLAESSNER,

Technical Advisor, Amalgamated Cotton Mills Trust Ltd., Manchester.

MATTHEW SILCOCK,

Lecturer in Textile Department, College of Technology, Belfast.

WALTER SIMON SONDEHELM, M.Sc.Tech., A.M.C.T.,

Textile Technologist, Ashton Bros. & Co. Ltd., Carrfield Mills, Hyde.

ARTHUR HORSFIELD WILD,

Chief Chemist, Dyeing and Shower Proofing Departments, J. Mandelberg & Co. Ltd., Salford.

### Institute Membership

The following applicants were elected to membership at the July meeting of Council:

#### Ordinary

John Anderson, B.Sc., A.R.C.S., 54, Welford Road, Sutton Coldfield, Warwickshire (Manager of Textile Laboratory, Textile Division, Dunlop Rubber Co. Ltd., Fort Dunlop, Erdington, Birmingham).

William Scott Anderson, 49, Northfield Avenue, Edinburgh 8 (Works Manager, Messrs. Munro & Co. Ltd., Restalrig Factory, Edinburgh 8).

Reginald Langham Elliott, Ph.D., B.Sc., F.R.I.C., H.M. Naval Victualling Depôt (Technical Examining Officer).

Alexander Frigyes, 4, Yefei Nof St., Tel-Aviv, Palestine (Textile-Technical Advisor).

Arthur Greenwood, F.C.S., 41, Highfield Hill, Upper Norwood, London, S.E.19 (Manager, Norwood and Dulwich Laundry & Cleaning Co. Ltd.).

M. H. Gutman, c/o Textile Department, The University, Leeds 7 (In Forces).

William Hardy, Carr Cliff, Warley, Halifax, Yorks. (Worsted Mill Manager, Patons & Baldwins Ltd., Clark Bridge Mills, Halifax).

Thomas Henry Ward Hulme, Sunnymead, Ivy Lane, Macclesfield (Weaving Manager, Brocklehurst-Whiston Amal. Ltd., Hurdsfield Mills, Macclesfield).

Arthur Muller, D.Sc., Colline Verte, Jedburgh, Scotland (Technical Controller, North British Rayon Ltd., Jedburgh).

Kenneth William Richmond, Ph.D., B.Sc., BM/YHFM, London, W.C.1 (Research Chemist, B. Laporte Ltd., Kingsway, Luton, Beds.).

William Edward Rose, McConnel & Co. Ltd., Manchester 4 (Managing Carder).

John Colin Schofield, B.Sc., Roseville, Water Lane, Farnley, Leeds (Director, Henry Lister & Sons Ltd., Troydale Mills, Pudsey, Nr. Leeds).

William Ewart Stanley, 7, New Lawn Road, Ilkeston, Derbyshire (Superintendent, Warp Knitting Dept., British Celanese Ltd., Spondon, Derby).

#### Junior

Robert Astin Holgate, B.Sc.Tech., 66, Raglan Road, Burnley, Lancs. (H.M. Forces).

# THE JOURNAL OF THE TEXTILE INSTITUTE

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## PROCEEDINGS

### Midlands Section

#### COLOUR AND DESIGN IN TEXTILES

with particular reference to Knitted Fabrics and Knit-wear Garments

By J. C. H. HURD.

*Paper delivered to the Midlands Section, 19th February, 1944.*

In the knitting industry two distinct types of designers are found—

1. The designers of garments, who would include about 80 per cent. of the designers employed in the industry, and who must be considered as fashion designers, i.e. designers of apparel. No adverse criticism has been made by the numerous critics of industrial design in the country of this type of designer as it is outside their scope.

2. Fabric designers, who are rarely employed solely as such except by machine builders and very large firms. Fabric design is undertaken by a variety of the personnel in the knitting industry from the manager to the versatile "hosiery mechanic."

The general classification regarding the type of ornamentation which has been applied to woven fabrics is equally applicable to knitted fabrics.

(a) The pattern effect may be produced in the case of woven fabrics by means of weave structure, and in the case of knitted fabrics by the stitch formation, or loop structure, in one colour only.

(b) Two or more colours may be used to form the pattern effect: the texture of the fabric remaining the same throughout its whole area.

(c) A combination of colour effect with varying texture weave or stitch may be employed. In weaving this is known as colour and weave effect.

So far as knitting is concerned the above definitions are independent of the additional effects obtained by horizontal striping.

With the object of obtaining some unification in this direction, I have introduced the term *Design Stitch Unit*. This term represents the stitch or group of stitches forming a unit of the ground or the design effect in a patterned area. This means that a minimum of two design units must appear on a fabric in order to produce a pattern or design effect.

As it has been said that draughtsmanship is the language of design, and the vehicle of thought, therefore I now propose to refer to the accompanying drawings.

Figure 1 is a loop drawing carried out in a semi-natural form especially prepared to illustrate the term *Design Stitch Unit* and is of the popular tuck-float-rib structure or honeycomb fabric.

This type of fabric is usually made on a machine having four feeders and it is usual when plotting a design on graph paper to let one square represent not one stitch but one revolution of the machine, because during one revolution of

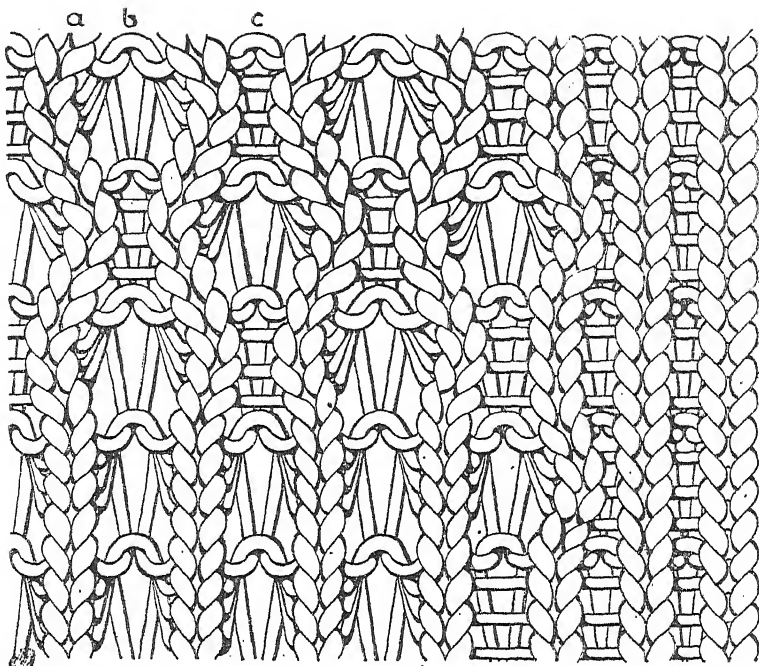
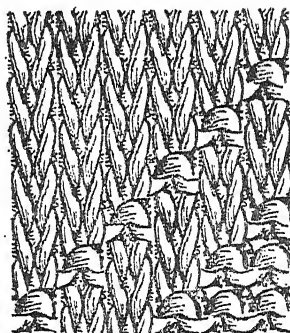
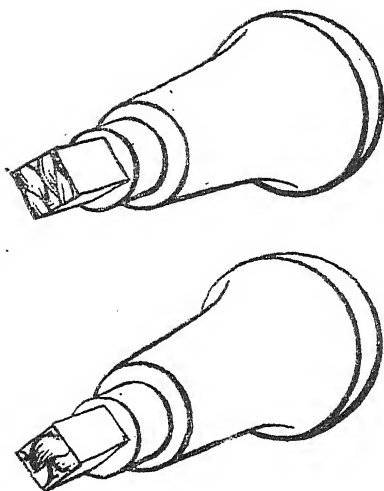


Fig. 1



A

Fig. 2

the machine one complete Design Stitch Unit is made. During one revolution four separate yarns are fed, but not necessarily knitted, to both rib and plain feeders.

The Design Stitch Units on this fabric comprise two different plain combinations or Design Stitch Units with the rib needles knitting all the time.

- (a) Four rib loops.
- (b) Three tuck and one knit (plain).
- (c) Three non-knit and one knit (plain).

Either of the two plain Design Stitch Units may appear anywhere on the fabric as decorative form according to the scope of the selecting mechanism. All the possible forms or combinations of the units are shown in the diagram.

A practical example of the use of Design Stitch Units in building up designs on squared paper, having a representative appearance, is shown in Figure 2.

The metal stamps I had made to illustrate the units, which are in this case the simple stitches plain and purl, can be used in combination with the results shown at A in Figure 2.

A large percentage of the knitted fabrics which offer scope for ornamentation are made on circular machines and for this reason, coupled with the fact that so far as underwear and outerwear are concerned British machinery has a pre-eminent position, I propose to limit any specific examples of design to which I shall refer, to those produced on circular knitting machinery.

Any attempt to discuss design from a practical point of view would be futile without some consideration of the mechanism used for the selection of the various design instruments.

The forms in common usage to-day may be divided into three groups—

- (1) Spiral type pattern wheels.
- (2) Multi-butt pressers, selectors or discs working on a depressing principle.
- (3) Full Jacquard mechanism.

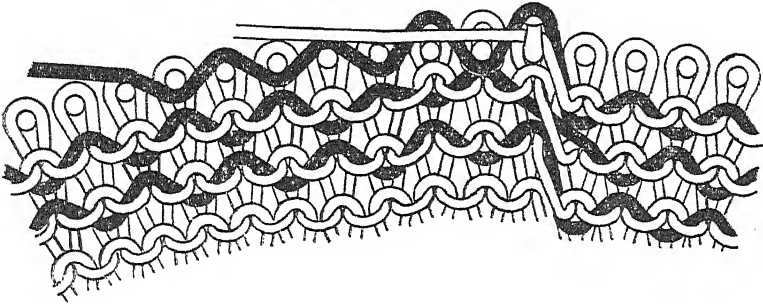


Fig. 3

Flat knitting machines are usually provided with a full Jacquard system of selection. Those mechanisms under Group 2 which are or are likely to be the most popular mechanisms may again be divided into three groups, although all three are similar in broad principle—

- 2a. Multi-butt pressers one to each needle, or instrument; the parent of this type is the Brinton trick wheel.
- 2b. An intermediate drum to carry the selectors or pressers.
- 2c. An intermediate built-up wheel employing cut discs in place of selectors or pressers.

In all three cases the pressers, selectors or discs are selected through intermediary means by a pattern drum which has an intermittent racking motion. This intermittent motion may take place in either direction or the drum may remain stationary on any one particular row or selection.

In some cases frangible bits are used as the change medium which are inexpensive and can be retained for use on future occasions.

In other cases push-in pegs are used, which method allows for the changing of designs at no cost.

The selecting mechanism referred to in Group 1 i.e. the spiral type design wheel still finds some application in most modern knitting machinery. The particular application I have in mind is on large diameter circular machines which are used for the manufacture of knitted piece goods or fabric in the roll for cut garments such as dresses, suits etc., and it is because this trade comes nearest to the woven trade that I give it prominence.

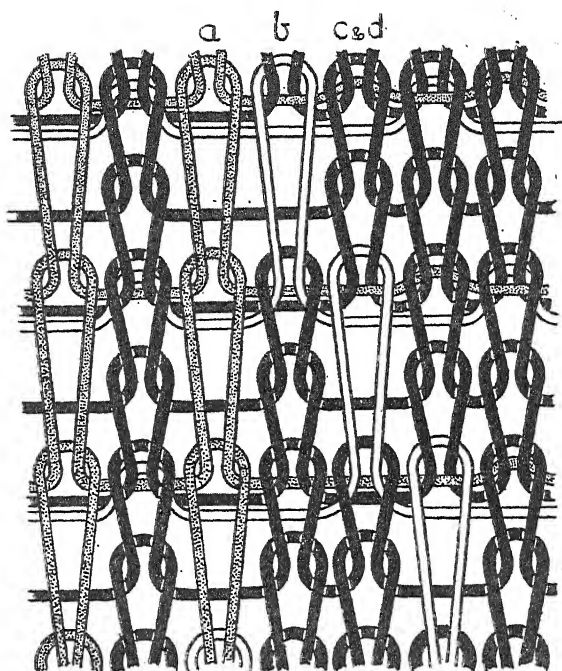


Fig. 4

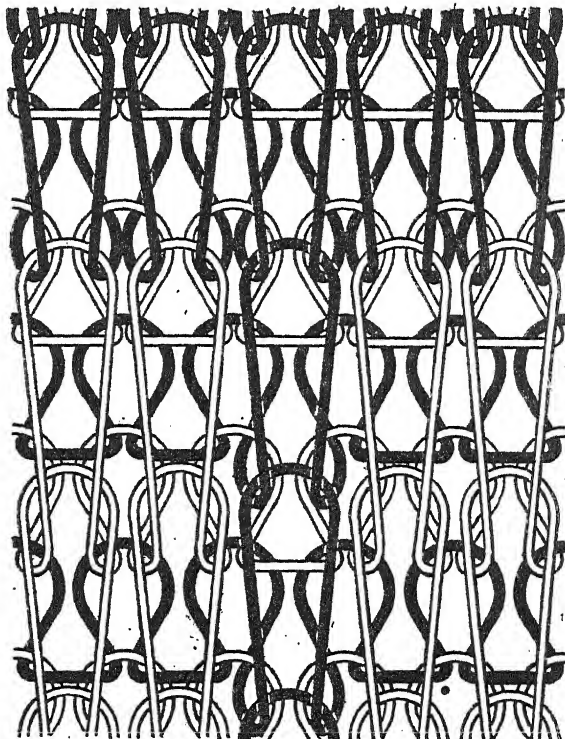


Fig. 5



The calculation involved in arriving at the design areas produced by this unique and simple patterning device is well known and it is sufficient for me to mention its chief draw-back, i.e. the inherent spiral bias which is inseparable in most cases with this type of mechanism.

The present-day application, i.e. for piece goods, does not call for large or well-defined designs, a fact which renders the spiral bias no great disadvantage.

Figure 3 illustrates the structure of a near-woven knitted fabric, i.e. laid-in fabric as made on the machine, the laid-in yarn and the ground yarn being fed at different feed points. At the laid-in feed point selected needles are raised to a tuck height while unselected needles non-knit, this merely corrugates the laid-in yarn round the needles and it is bound into the fabric by the ground yarn at the next feeder.

The particular construction shown, i.e. odd needles tucking the laid-in yarn at one lay-in feeder, and even needles tucking the laid-in yarn at the next lay-in feeder is known by a borrowed weaving term, i.e. hopsack.

The firmness of this structure is undoubtedly due to the laid-in yarn becoming almost a straight weft yarn and incidentally this structure gives the most scope for the use of fancy yarns particularly of the knop variety. Knop yarns cannot be knitted successfully on knitting machines because the knop will not run through the needle hook when the loop is being pulled, but if the knop yarn is laid-in it never is drawn by the hook of the needle.

Another example of a near woven fabric is shown in the construction given in Figure 4.

This is selective accordean fabric, the catching-in or accordeaning preventing the long floats which would appear on the back of the fabric when the particular yarn is not required to be shown on the face of the fabric. This locking in is done in the same way as in laid-in fabric only the same yarn is both laid-in and knitted.

It will be noticed on this particular construction that the ground yarn, shown black in the diagram, is knitted twice for each single course of the two pattern yarns, i.e. white and grey respectively in the diagram. This is in order that the pattern should present a more bold appearance against the ground.

The design stitch units comprise :

*a* and *b* design stitches (long) with three yarns floated at the back of each loop (which equals four potential courses).

*c*. Ground-stitches which may be accordeaned with either of the two design yarns or the design yarn may be floated at the back (equals three potential courses).

*d*. Ground stitches not accordeaned (equals one course).

It takes four feeders to produce one complete row or course or one design stitch unit. The depth of the design area which expressed in loops is 72 courses is therefore reduced to 18 deep when the depth is expressed in terms of design stitch unit, with each area rising three courses.

Any lecture on knitted fabric design would be incomplete without mentioning the rib jacquard structure which although only used to a limited extent to-day is probably the most important of any knitted fabric from an ornamental point of view and certainly gives the most scope for the introduction of colour in the pattern.

It is, like the selective accordean fabric, another example of that class in which two or more colours may be used to form the pattern effect; the texture of the fabric remaining the same throughout its whole area.

Figure 5 shows a two-colour structure of this fabric and if black and white represent the two yarns used, the two possible design stitch units are :

(a) White face loop with one black and one white rib loops.

(b) Black face loop with one black and one white rib loop.

In the general classification of selecting mechanisms used on circular knitting machines the second group—"mechanisms incorporating multi-butt pressers, selectors or discs working on a depressing principle" is by far the most popular.

It is very much allied to the dobby mechanism giving a reasonable scope combined with simplicity of pattern change. Furthermore as the intermittent drum is able to be racked in either direction and the pressers set out in diverse ways the expression Design Area is rendered a doubtful means of denoting the scope of the mechanism or machine concerned.

Owing to the different structural effects possible on machines equipped with these types of selecting mechanisms each effect probably embodying a different number of loops in the design stitch unit, different design areas are often quoted or defined on a particular machine to cover this variance.

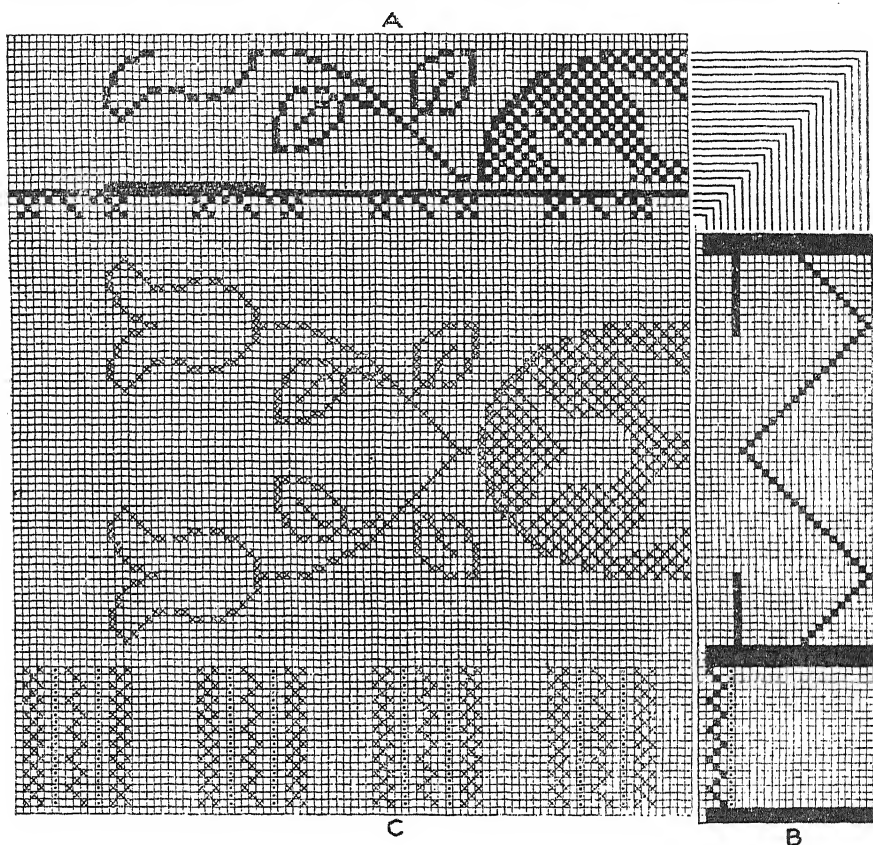


Fig. 6

Of the three types of selecting mechanisms mentioned in the second group, the first type embodies all the possible arrangements of the other two types, hence it is this mechanism that I refer to in detail.

The mechanism is defined specifically as having "multi-butt position pressers, one to each needle," and there are two distinctly different ways of setting out these pressers and the two ways are occasionally combined. (1) The design may be set out on the pressers themselves with substantially one butt or peg in each vertical row of the intermittent drum and the scope may be defined as "a number of horizontal rows giving an unlimited width of design, the number of rows being equal to the number of butt positions on the pressers, with each or any row selected at will from the intermittent drum. The basic depth of the design in stitches is equal to the number of times each or any of the horizontal rows may be selected, and is equal to the number of racks or rows in all the stitch selecting intermittent drums."

Expressed in terms of design stitch units the basic depth should be divided by the number of loops or potential loops in the design stitch unit. The term basic depth is used to define the maximum depth of design possible without dwelling on any particular selector or reverse racking the intermittent drum.

Figure 6 shows a design of this type. The set-out of the pressers round the needle cylinder underneath the needles is shown at A and the set-out of the intermediate drum is shown at B. This drum is shown turned round at right angles to its normal plane in order to show the relationship between the operating rows of the two elements, the pressers in the cylinder and the tricks in the intermediate drum. The main area of the diagram C shows the results obtained by the inter-action of the pressers and the tricks in the intermediate drum.

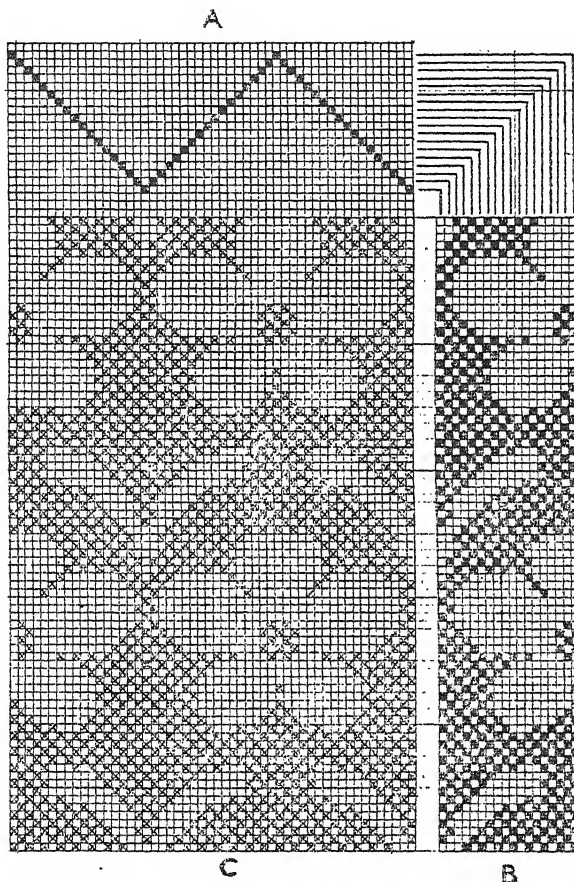


Fig. 7

It will be seen that two distinct decorative forms are disclosed in the resultant areas. The particular pattern illustrated is for a lady's vest and the lower area which comprises substantially a vertical effect, which is extended by reverse racking, is for the skirt of the garment whilst the upper motif is for the upper part of the garment and between the two is a band of  $2/2$  rib for the waist. The analogy with the dobby mechanism will readily be seen from the diagram.

(2) The second method of setting out designs is substantially a reversal of the first method, with one butt only on each presser, each butt in a series being in a different plane, the number of possible planes being equal to the number of butt positions. The pattern in this case is set out on the intermittent drum and the scope may be defined as "A number of vertical components or strips,

the number of different components being equal to the number of butt positions." These vertical components may be arranged in any order. Each vertical component has a normal or basic depth in stitches equal to the number of racks or rows in all the stitch selecting intermittent drums, which may be converted into units of stitch design as previously described.

The most simple arrangement of this type is shown in Figure 7. This is known as a zig zag or reflex set and gives a turn-over type of pattern. As before, the presser set-out is shown at A and the set-out of the intermittent drum is shown at B, which is again shown turned at right angles to its normal plane.

The main area of the diagram C again shows the pattern obtained by the inter-action of the two co-operating elements, i.e. the pressers underneath the needles in the cylinder and the tricks in the intermittent drums. As this is an "all-over" pattern, the intermittent drums are racked continuously while making the patterned area of the garment, no reverse racking being necessary.

Mr. Hurd also briefly expounded the various colour systems with special reference to the Ostwald developments in colour science and explained the peculiar effects of stitch structure on the harmony and contrast of colours in juxtaposition, production of "shot" effects, colour problems in reverse plating and the combination of warp and weft knitted colour designs.

**EXAMINATIONS, 1944**

The following passes have been recorded in the Examinations held in relation to the Associateship of the Textile Institute in April and May, 1944, at Belfast, Glasgow, London, Manchester and Cambridge (U.S.A.):

*Preliminary Examination*

C. F. Cape, Halifax.

\*J. Settle, Bolton.

\*E. Wadsworth, Derby (Essay only).

*Examination in General Textile Technology*

\*H. Bratherton, Eccles.

\*C. M. McNeil, Paisley.

\*S. H. Brown, Braintree.

\*A. V. Pringle, Belfast.

\*V. Castle, Farnborough.

\*J. Settle, Bolton.

\*S. Fallon, Belfast.

\*J. L. Sharp, Manchester.

\*J. Harrison, Huddersfield.

\*H. Sneyd, Oldham.

\*N. Jackson, Accrington.

\*E. Wadsworth, Derby.

\*C. W. Jorgensen, Bradford.

R. Walton, Spondon.

\*R. L. Kitchen, Huddersfield.

\*J. R. Waterhouse, Leek.

Names marked with an asterisk are of candidates who have now completed the qualification requirements for the award of Associateship (A.T.I.).

**Diplomas**

Elections to Fellowship and Associateship have been completed as follows, since the appearance of the previous list (June issue of the *Journal*):

**FELLOWSHIP**

John Boulton, M.Sc.Tech., A.M.C.T., F.R.I.C., Research Chemist, Courtaulds Ltd., Bocking.

James Alexander Ireland, Proprietor, James Ireland & Co., Belfast.

Joseph Noguera, A.M.I.Mech.E., Managing Director, Casablancas High Draft Co. Ltd., Salford.

Charles Smalley Whewell, B.Sc., Ph.D., Lecturer in Cloth Finishing, Leeds University.

**ASSOCIATESHIP**

Harry Bratherton, A.M.C.T., Analytical Chemist, Chemical Inspection Dept., Ministry of Supply.

Stanley Howard Brown, Senior Assistant, Research Laboratories, Courtaulds Ltd., Braintree.

Sylvester Fallon, Textile Machinery Development, James Mackie & Sons, Ltd., Belfast.

Oswald Glaessner, Technical Advisor, Amalgamated Cotton Mills Trust Ltd., Manchester.

James Harrison, Foreman Dyer, G. & H. Roberts Ltd., Holmbridge.

Norman Jackson, A.M.C.T., Cloth Analyst and Textile Adviser, Calico Printers Association Ltd., Accrington.

Conrad William Jorgensen, Rayon Weaver, Home Silks Ltd., Bradford.

Ronald Lancaster Kitchen, Dyer and Chemist, John Kaye & Sons, Ltd.

Claud McFarlane McNeil, B.Sc., Chemist, J. & P. Coats Ltd., Paisley.

Alexander Vernon Pringle, Technical Executive, James Mackie & Sons Ltd., Belfast.

James Settle, Head of Textile Dept. (Evening), Radcliffe Technical School.

Matthew Silcock, Lecturer, Textile Dept., College of Technology, Belfast.

John Leslie Sharp, Research Chemist, British Cotton and Wool Dyers Association Ltd., Manchester.

Harold Sneyd, Woollen Spinner, Courtaulds Ltd., Arrow Mill, Rochdale.

Walter Simon Sondhelm, M.Sc.Tech., A.M.C.T., Textile Technologist, Ashton Bros. & Co. Ltd., Hyde.

Ernest Wadsworth, Chargehand Colour Mixer, British Celanese Ltd., Derby.

James Roy Waterhouse, Assistant Dyeworks Manager, Brough Nicholson & Hall Ltd., Leek.

## **Institute Membership**

The following applicants were elected to membership at a recent meeting of Council:

### *Ordinary*

- Frederick Arthur Beasley, 9, Glenview Drive, Nab Wood, Shipley (Buying Manager—Rayons, Henry Frame & Lauder Ltd., Manchester).  
 William Henry Billington, 5, Marne Crescent, Rochdale (Head Carder, Warwick Mills Co., Middleton).  
 George Ashford Bradbury, Chesterfield, Cross Avenue, Blackrock, Co. Dublin (Hosiery Manufacturer, A. Bradbury Ltd., Earl Shilton, Nr. Leicester).  
 Harold Chorlton, 32, Marne Crescent, Rochdale, Lancs. (Trade Union Secretary, 5, Baillie Street, Rochdale).  
 Brian Cameron Gee, B.Sc., Mountain View, Lambeg, Lisburn, N. Ireland (Assistant Chemist, Linen Industry Research Association, Glenmore House, Lambeg).  
 Ernest Higgs, A.M.C.T., "The Doric," 60, Cantley Lane, Doncaster (Manager, British Bemberg Ltd., Wheatley, Doncaster).  
 Arthur Reginald Knight, B.Sc., A.R.C.S., A.R.I.C., 7, The Grove, Wheatley Hills, Doncaster (Assistant Manager, British Bemberg Ltd., Doncaster).  
 Charles Ikin Leather, B.A. (Cantab), Chepstow, Burley-in-Wharfedale, Yorks. (Textile Machine Maker, P. & C. Garnett, Wharfeworks, Cleckheaton).  
 Walter P. Miller, 16, Ash Gardens, Headingley, Leeds, 6 (Chemist in Dyeing Laboratory, Clemons, Marshall & Carbert, Hunslet Road, Leeds, 10).  
 William Munro Munro, Munro & Co. Ltd., Restalrig Factory, Edinburgh (Director).  
 Pennant G. Phillips, A.M.C.T., St. Mary's Place, Nottingham (Sales Manager and Director, Macpherson & Phillips Ltd.).  
 Robert Gray Reid, A.R.I.C., 65, Church Street, Broughty Ferry, Dundee, Angus (Textile Chemist, c/o Baxter Bros. & Co. Ltd., Dens Works, Dundee).  
 Geoffrey Robinson, 2, Beaumont Street, Longwood, Nr. Huddersfield (Assistant Mill Manager and Wool Blender, Ben Hall & Son Ltd., Spring Garden Mills, Milnsbridge, Nr. Huddersfield).  
 George William Taylor, Court View, Churchgate Reclamation, Bombay, India (Carding and Spinning Master).

## **Obituary**

The Institute regrets to announce the death of the following member who was a Past-President of the Institute:

JOHN EMSLEY, J.P., F.T.I., Bradford,

## **Employment Register**

The following announcement is taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:

- No. 237—Young man, exempt from military service, requires position as Assistant Manager or Technical Assistant to Manager in Woollen Spinning Mill. City & Guilds Full Technological Certificate in Woollen Yarn Manufacture. Experience in all departments of woollen spinning.

## **NOTICES: INSTITUTE MEETINGS**

### **LANCASHIRE SECTION**

Friday, 8th September—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's Premises. "Tyre Cords, Rayon: Cotton," by A. Scholes, A.T.I.

# THE JOURNAL OF THE TEXTILE INSTITUTE

Vol. XXXV

SEPTEMBER 1944

No. 9

## PROCEEDINGS

### Presentation to Mr. F. Nasmith

At the September meeting of the Council Mr. F. Nasmith was presented with a suitably inscribed silver rose bowl, as a token of appreciation of his valuable services to the Institute as Honorary Secretary from 1930-44. Mr. Nasmith retired from this position in May, because of health reasons. The presentation was made on behalf of the Council by Mr. H. G. Greg, the Chairman, who pointed out that Mr. Nasmith was a Foundation Member of the Institute. In addition he had been President in the year 1938-39, and had acted in numerous other capacities during his long association with the Institute.

Mr. Nasmith expressed his sincere thanks to the Council for the presentation, and said that his work for the Institute had always given him much pleasure. He added that he would still be available to give whatever assistance he could in the future.

### Conference on "Dust in Cardrooms"

The Institute is arranging a conference on the subject of "Dust in Cardrooms," to be held at the Midland Hotel, Manchester, on Saturday, 18th November, 1944. There will be a morning and an afternoon session, and it is anticipated that there will be several papers for discussion. If possible, pre-prints of the papers will be made available before the date of the meeting to those intending to be present. Full details of the conference will be supplied later.

### Back Issues of the Journal.

If any member of the Institute has any copies of the *Journal*, either recent or old editions, which he no longer requires, the Institute would be pleased to have them. This also applies to the Index to the Journal. Details of copies which are available should be addressed to the Acting General Secretary, The Textile Institute, 16 St. Mary's Parsonage, Manchester, 3.

### TEXTILE INSTITUTE COMPETITION AWARDS, 1944

The number of entries for the 1944 Competition was again quite high in view of the difficult conditions under which students are working. An increasing interest is being taken in Textile Design and it is felt that the competitions play a useful part in this respect.

Prizes award in the 1944 competitions provided from the Lieut. Harry Dent Crompton Prize Fund and the Beanland Bequest are announced as follows:—

### War-Time Competition

- First Prize (£10) ... Gordon Haigh Beevers, 42 Syringa Street, Marsh, Huddersfield (Huddersfield Technical College).
- Second Prize (£6) ... Harold Robinson, Cliffe Cottage, The Cliffe, Ramsbottom (Bury Municipal Technical College).
- Third Prize (£4) ... Horace Boswell, 3 Malvern Road, Bywell Road, Dewsbury (Dewsbury Municipal Tech. College).
- Prizes of £2 each ... John Fielding, 2 Clement Street, Birkby, Huddersfield (Dewsbury Municipal Technical College).  
Jeanne Audrey Pakes, 1 Smithville, Riddlesden, Keighley (Keighley Technical College).  
Lewis Dalglish Jones, 16 Fir Road, Paddock, Huddersfield (Huddersfield Technical College).

### “F” Competition : Designs for Printed Fabrics

#### *Class I :*

- First Prize (£6) ... William Roy Birch, 33 Balmoral Road, Denton, Nr. Manchester (Manchester Municipal School of Art).
- Second Prize (£4) ... Stella Mary Sparks, 35 Chichester Gardens, Ilford, Essex (South-East Essex Technical College).
- Third Prize (£2 10s.) ... Constance Margaret Sherwin, 134 Hartington Street, Moss Side, Manchester, 14 (Manchester Municipal School of Art).

#### *Class II :*

- First Prize (£5) ... Joan Beaumont Fish, 51 Bolton Road, Pendlebury, Manchester (Salford School of Art).
- Second Prize (£4) ... Joan Edith Singleton, 9 Avonlea Road, Sale, Cheshire (Manchester Municipal School of Art).
- Equal Third Prizes £2 10s. (each) Malcolm Law Stead, 12 Crow Tree Lane, Bradford (Bradford Technical College).  
Agnes McNeil Graham, 9 Hillard Road, Clarkston, Glasgow (Glasgow School of Art).

### “G” Competition : Special Woven Fabric (Worsted)

- First Prize (£3) ... Harold Weston, 1 Redesdale Gardens, Adel, Leeds, 6 (Leeds University).
- Second Prize (£2) ... Thomas Desmond Brown, 143 Westfield Road, Heaton, Bradford (Bradford Technical College).
- Third Prize (£1) ... Keith Whiteley, 6 Mitchell Street, Sowerby Bridge (Halifax Municipal Technical College).

### “H” Competition : Woven Fabric (Worsted)

- First Prize (£3) ... Neville Stanley Maw, 6 Avondale Place, Manor Drive, Halifax (Halifax Municipal Tech. College).
- Second Prize (£2) ... Thomas Desmond Brown, 143 Westfield Road, Heaton, Bradford (Bradford Technical College).
- Prizes of £1 each ... William Edward Johnson, 4 Finkle Street, Sowerby Bridge (Halifax Municipal Technical College).  
Harold Broughton Jowett, Wayside, 20 Redburn Road, Shipley (Bradford Technical College).  
Geoffrey Howard Foster, 13 Spring Hall Drive, West End, Halifax (Halifax Municipal Technical College).



## *General Items*

### **Institute Membership**

The following applicants were elected to membership at a recent meeting of Council:

#### *Ordinary.*

- Leslie Acton, 52, Vauxhall Drive, Braintree, Essex (Power Loom Overlooker, Courtaulds Ltd., Braintree).  
Henry A. Bell, 6, Cranmer Grove, Mansfield, Notts. (Departmental Manager, Wm. Hollins & Co. Ltd., Pleasley Works, Nr. Mansfield).  
Frank Clarkson, H.M. Forces (former Designer, Redman & Smith, Standard Mills, Crosshills, Nr. Keighley).  
William Halstead Dawson, 66, Claremont Place, Todmorden [General Manager and Director, John Dawson & Sons (Todmorden) Ltd., Albion Mill, Todmorden].  
Margaret Eastham, B.Sc.Tech., 17, Edward Street, Nelson, Lancs. (Textile Assistant, Ministry of Supply, 28, Quay Street, Manchester).  
Edwin Arthur Gill, B.Sc., Y.M.C.A., Forster Square, Bradford (Textile Research Chemist, B.D.A. Ltd., Bradford).  
John William Greenwood, 10, Barlow Street, Rawtenstall, Rossendale (Carder-Ring Foreman, Victoria Works, Cloughfold, Rossendale).  
Thomas Helliwell, 151, Wibsey Park Avenue, Bradford, Yorks. (Textile Manufacturer, Helliwell & Greenough, Marsh Street Works, Bradford).  
Leslie Howard Kirkham, "Woodclyffe," 34, Fellows Road, Beeston, Notts. (Hosiery Viewer—Admiralty).  
Kenneth Knox, 26, Avondale Crescent, Shipley, Yorks. (Woolcombers' Manager, Richmond Combing Co. Ltd., Richmond Road, Bradford).  
Edward Jollasse Miles, B.Sc., A.R.I.C., 12, Oak Road, Leeds, 7 (Government Inspector, Ministry of Aircraft Production).  
Frederick William Olive, Crumpsall Mill, Lower Crumpsall, Manchester, 8 (Manager, J. Austin & Sons Ltd.).  
Thomas Norman Richardson, B.A., M.Sc., F.R.I.C., Kilmeny, 26, John Street, Gourrock, Renfrewshire (Chemist, Gourrock Ropework Co. Ltd., Port Glasgow, Renfrewshire).  
Edwin R. Winton, B.Sc., Ph.D., 17, Townhead, Kilwinning, Ayrshire (Research Chemist, Imperial Chemical Industries Ltd., Nobel House, Stevenston).

### **Obituary**

The Institute regrets to announce the death of the following members:

J. B. BRAZIER, Macclesfield.  
SIR ARTHUR HAWORTH, Manchester.  
T. ROBERTS, Morley.  
W. WILKINSON, Blackburn.

### **Employment Register**

**WEAVING MANAGER WANTED.**—Knowledge of flax weaving desirable but not essential. Position includes control of ancillary departments, all scheduled under Essential Works Order.—Apply in confidence, stating experience, age and present position to: The Secretary, The Gourrock Ropework Co. Ltd., Port Glasgow.

**COURTAULDS LIMITED.**—Applications are invited from Textile Technologists, Specialists in Weaving, Dyeing or Textile Finishing, Research and Development. Applicants should possess a good general education, should preferably be graduates, A.T.I.'s., or possessors of City and Guilds Full Technological Certificates, and have sound practical experience in some branch of the Textile Industry.—Applications should be addressed to the Director of Personnel, Messrs. Courtaulds Limited, 16, St. Martin's-le-Grand, London, E.C.1.

**FIRST-CLASS TEXTILE MANAGER WANTED.** Must be practical man with experience of production and control of female labour mainly on viscose rayon. Knowledge of winding machines essential. State salary and qualifications. A.T.I. preferred. Good post-war prospects. Write C.Y. c/o J. W. Vickers & Co. Ltd., 7/8, Gt. Winchester Street, E.C.2.

The following announcement is taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:

No. 137—Young man, exempt from military service, requires position as Assistant Manager or Technical Assistant to Manager in Woollen Spinning Mill. City & Guilds Full Technological Certificate in Woollen Yarn Manufacture. Experience in all departments of woollen spinning.

## NOTICES: INSTITUTE MEETINGS

### LANCASHIRE SECTION

Saturday, 7th October, 1944—*Manchester*. 2.45 p.m. Lecture on "The Molecular Structure of Fibres," by Dr. W. T. Astbury, M.A., Sc.D., F.R.S., F.Inst.P. (Leeds University). The meeting will be held at the Institute's premises.

Friday, 13th October, 1944—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's premises. "For Whom the Bell Tolls," by C. M. Whittaker, B.Sc. (Courtaulds Ltd.).

### MIDLANDS SECTION

Saturday, 28th October, 1944—*Leicester*. 3.0 p.m. Lecture on "Air Conditioning for Industry with Particular Reference to the Textile Trade," by F. Wright, A.M.I.E.E., M.I.H.V.E. The meeting will be held at the Leicester Colleges of Art and Technology.

### YORKSHIRE SECTION

Thursday, 19th October, 1944—*Bradford*. 6.30 p.m. Lecture on "X-Ray Analysis of Fibres," by Dr. W. T. Astbury, M.A., Sc.D., F.R.S., F.Inst.P. (Leeds University). The meeting will be held at the Midland Hotel.

# THE JOURNAL OF THE TEXTILE INSTITUTE

Vol. XXXV

OCTOBER 1944

No. 10

## PROCEEDINGS

### Lancashire Section

#### TYRE CORDS—COTTON AND RAYON

By A. SCHOLDS

*(Paper delivered to the Lancashire Section, 11th September, 1944)*

The powerful stimulus given to industry by the demands of modern warfare is now well-known. The Textile Industry, being one of our basic industries, is obviously one which is affected by the sudden impact of requests for abnormal quantities and new requirements.

The urgent necessity of supplying these requirements results in phenomenal activity in research and works experimentation in order to devise more productive methods and in the use of substitutes for materials which were formerly cheap and easily accessible. In some instances the result is an adverse one, whilst in others the result is an advantageous one.

One can say with certainty in all cases, that the new conditions are conducive to an examination of many things normally taken for granted, with the frequent result that new knowledge is obtained and progress is simultaneously accelerated.

Within the Textile Industry itself, that section which deals with tyre cords, has among many others been so affected. The elimination from the market, of supplies of natural rubber due to Japanese conquests, focused attention upon a vital part of the development plans of the Allies.

Conservation of natural rubber became suddenly a grave national problem and the chemical industry was most urgently directed towards the production of synthetic rubber.

The behaviour under tests of tyres made from natural rubber, mixtures of natural rubber with synthetic rubber, and wholly synthetic rubber, naturally led to a study of the effects of cords upon the life and strength of such tyres. As rayon had already been advocated before the war as an improved material for cord fabrication the relative merits of cotton and rayon became a deciding factor in planning ahead. To a very large extent these developments originated in America and led to bitter controversy between the cotton and rayon business interests, with the publication of wild and exaggerated claims for the performances of these competing cords. Unfortunately few technical data were published, and of that published, much was clearly unreliable. In Great Britain, very little knowledge or experience of rayon was available in the tyre making concerns—certainly in 1942 no unanimous opinion could be expressed. Since 1942 steady progress has been made, and we are now in a position to assess roughly the relative merits of the two fibres, cotton and rayon. The object of this paper is to record the developments of this period and to record the separate claims which have been put forward.

The immediate implications of the problem indicated that research on new cords had two main objects in view:—

- (1) To conserve rubber by a direct physical saving.
- (2) To conserve rubber, natural or synthetic, by increasing the life of the tyre.

The first object can be achieved by reducing the amount of rubber in the tyre, providing the strength of the cords is still maintained at an adequate margin of safety. By utilising a thinner cord of a relatively higher strength the construction of the tyre walls and carcass can be reduced and by the introduction of rayon cords a saving of at least 0·2 lb. of rubber per lb. of cord was made in this way. This development was quickly followed by the introduction of a thinner cotton cord with similar rubber saving properties.

The second object demands much more careful study and a thorough understanding of what happens during the life of a tyre. Knight<sup>1</sup> has stated the following:—

“Consider the requirements of that most familiar of all textile-rubber productions, a modern automobile truck tyre; consisting of 13 lb. of cotton in the form of six distinct types of fabric, and 48 lb. of seven differently compounded rubber mixings, with 5 lb. of high tensile steel wire to anchor it to the wheel. It has to withstand the tractive effort involved in moving a load 35 times its own weight at temperatures commonly reaching 100° C. and at speeds which flex it between cycles of high and low stressing more than 20,000 times every hour, with frequent impacts which involve local stresses which must closely approach the ultimate bursting strength of the tyre. Further, we must cater for abrasion wear caused by uneven relative movement between tyre and road, as in rapid acceleration, braking, cornering, or due to slight mechanical defects in the vehicle; provision must be made against the chafing set up between resilient tyre and rigid wheel rim as the tyre is flexed; for the varying degree of distortion of different parts of the tyre, e.g. beads, sidewalls, and tread; and for dissipation of the heat generated in flexing.”

It is evident that other considerations than tensile strength apply and some of these points will be tentatively discussed. Before doing so, it is proposed to review what progress has been achieved so far.

#### High Tenacity Rayon.

For cord purposes practically all rayon used at present is spun by the viscose process. It is well known that, in general, increased degrees of tension during spinning yield higher tensile strengths and lower elongations. Comparative figures are as follows:—

	Grams/denier Conditioned	Extension	Grams/denier	
			Wet	Extension
Normal viscose rayon ...	2·0	18%	1·0	25-30%
High tenacity rayon ...	3·0-4·0	9-18%	2·1-2·2	18-21%

Viscose yarn spun by the Lilienfeld process has a very high strength, but a very low elongation and such yarn has so far not been found satisfactory for tyre cord purposes. Just before the war rayon for tyre cords was spun by the two-bath process which yielded a reasonably high tensile strength of 3 g.p.d. with an elongation of 14-18 per cent. In this method the partially decomposed cellulose xanthogenate thread from the normal spinning bath is immersed directly into a very hot water bath. A severe swelling and stretching takes place accompanied by more complete decomposition of the xanthogenate. In this way a more fully oriented thread of higher tensile properties is obtained. Desulphurisation and washing operations result in a regenerated cellulose of otherwise practically normal characteristics. This yarn is supplied on 5 lb. cones and cheeses or beams for twisting into tyre cords.

Before the war the standard rayon denier was 275 with 120 filaments. This was twisted into a cord of the following specification:—

Singles.	275 denier	...	4	turns per inch.	"Z" twist.
Five fold ply	...	18	"	"	"
Three fold cable...	...	10	"	"	"S" "

More recent investigations have shown that improved properties can be obtained by spinning a much heavier denier and the present type of viscose is now produced as 1,180 denier with 500 filaments, and this has completely superseded the older 275 denier type.

The benefits resulting from this change to a heavy singles yarn of not less than 1,000 denier with a plurality of single filaments are, according to B.P.512,002:—

- (1) Increased resistance to flexing.
- (2) Greater uniformity.
- (3) Lower cost of production.
- (4) Lower costs of processing.
- (5) Better adhesive properties after "doping."

With this particular type of rayon new twist constructions were adopted and the first type was a two-fold yarn with 13 turns per inch "Z" twist on the singles and 13 turns per inch "S" twist on the doubled cord. Subsequently, these twist constructions have been slightly varied and a three-fold cord is also used for certain types of tyres.

#### Cotton Cords.

Each tyre manufacturer has his own varied specifications, according to the type of tyre which he is producing, and the range is too varied to give individual comparisons. For convenience, therefore, any figures are based on a standard 23/5/3. The type of singles is however reasonably relative throughout the range.

The American type fabric is made from a good class carded American cotton, having an average staple of approximately 1 inch.

The Egyptian type is mainly divided into three classes; Carded Uppers, Carded Giza type, or Combed Giza type. The bulk in the past has been Carded Uppers having a staple of approximately 1½ in., but during the past two years, the tendency towards better class cotton, namely, Giza, has been decidedly marked. In Carded Giza, the average staple is approximately 1⅜ in., whilst in Combed, the average staple is approximately 1½ in.

The twist in the single is governed by the desired result in the cord. In the period prior to 1939, when high elongation was paramount, the singles twist was 21 turns per inch, but with the demand for low elongation, this was reduced and is now more in the neighbourhood of 16½ turns. So far as the singles strength is concerned, no tyre manufacturer sets any definite standard. Twist of course has a decided bearing on tensile strength and the fabric manufacturer forms his own basis from actual results. As a grade, the following strengths for 23s would be considered satisfactory:—

American	...	...	...	75 lb.	} All for 1 Lea.
Carded Uppers	...	...	...	95 "	
Carded Giza type	...	...	...	115 "	
Combed Giza type	...	...	...	145 "	

Prior to 1939, the demand was largely for high elongation cords showing mainly 20 to 22 per cent. elongation in the case of American yarns and 22 to 24 per cent. in Egyptian. These elongations represent the figures at 10 lb. loading.

There were, of course, variations, but the above were the general rule. As ideas changed and fabric of almost minimum elongation was required, production methods had to be adjusted to meet the new demand. Whereas in the past 22 per cent. could be taken as a reasonable average, the figure now wanted was more in the region of 7½ per cent. The different manufacturing methods, principally wet doubling as against dry doubling, etc., affected the strength, resulting in a higher tensile strength for a given count and for low elongation

as against high elongation. A comparison of cord strength tests of high and low elongation types shows the following:—

	High elongation	Low elongation
American ... ..	15-16 lb.	18-19 lb.
Carded Uppers ... ..	17-18 „	19-20 „
Carded Giza ... ..	18-19 „	21-22 „
Combed Giza ... ..	19-20 „	22-23 „

These figures refer to breaking strengths at 65 per cent. Relative Humidity which is the standard humidity for both cotton and rayon.

#### [Doubling of Tyre Cords.

Both rayon and cotton are doubled on the standard type of heavy machine using  $3\frac{1}{2}$  in. and  $5\frac{1}{2}$  in. rings. Small modifications are necessary for rayon such as lighter travellers, and the elimination of rough rollers and guides, etc., but in general no difficulty has been experienced by the trade. There has been no concession on the part of cotton doublers to work at relative humidities favourable to rayon, but quite good results have been obtained. The main technical consideration has been to obtain low extensibilities and high strengths. Mostly in the case of cotton, wet stretching is applied, which consists of running the cord through water to which is added resin or starch, in order to obtain a compact thread of smaller gauge, higher strength, and lower extensibility. Various types of stretching methods are in use, the standard method being by the application of a nip between heavy rollers on the doubling frame, followed by the manufacturer's personal choice of size of ring, depth of ring and weight of traveller.

The cord may then be further stretched on a stretching machine which consists of pairs of grooved cone rollers round which the yarn is passed. The gradually increasing peripheral speed effects the stretching process. One other method consists of incorporating pairs of stretching rollers on the doubling machine itself and locating these midway between the creel and the lappet ring guides. These may be individually driven by one fixed cone and one idler cone or they may be driven by a shaft running the length of the machine as in the Winterbottom process B.P.526,240. One other method, the Langstreth double twister may also be used. According to B.P.496,645 cotton yarns may be doubled at normal tensions but stretched before, during or after a vacuum steaming operation. In some cases the whole of the necessary stretch is not applied during the making of the cord, but may be added at a later stage, such as in the dipping process before rubbering by the tyre manufacturer. Except in the dipping process rayon cords are all dry stretched. The singles yarns for twisting are contained on cones or cheeses which rotate on the creel pegs of the machines or may be supplied on beams which are suspended either parallel or at right angles to the axis of the machines, and the individual threads guided to their respective twisting heads on the frame.<sup>2</sup>

A recent innovation has been the use of pre-stretched rayon yarn to simplify the stretching process and to give a lower elongation to the resultant cord. This method has found great success in America and is at present being tried in this country. At the moment unanimity of opinion is not found amongst the tyre manufacturers, but independent tests are now being made. By this method the elongation of the singles yarn at 65 per cent. R.H. is reduced to 10-12 per cent. and the stretching reduces the denier, but induces a somewhat higher tensile strength.

It is claimed in B.P.504,497 that better flexing values can be obtained and an increase in flexing life of 20 per cent. is stated. B.P.527,170 states that by prestretching the singles yarn, much greater uniformity is obtained particularly with regard to the stress-strain curve characteristics.\*

In practice the stretching is attended with certain difficulties which are now being overcome. The demand is generally for 90 ends of 1,180 denier rayon on beams 54 in. wide, and it is a difficult practical proposition to lay so few ends

evenly over such a width without causing plucking and lost ends in the subsequent unrolling. With so few ends per yard, the weight per unit length is much lower than in any usual beam and production suffers accordingly. The stretching was originally done on a Johnson type sizing machine and a week's production was only 1,000 lb. of yarn. The shortage of such machines and labour difficulties are the main reasons why satisfactory results of this process are not yet available in this country. Progress is being made, however, and the production has been increased to 5,000 lb. per machine and improvements in quality simultaneously achieved.

It is clear from the results obtained that rayon can be processed for tyre cords just as easily as cotton, and in fact, at a somewhat higher production per operative. The abolition of the wet stretching process makes for much cleaner machines and working conditions and there is a marked absence of loose fibres. Some difficulty may be obtained by knots slipping, but a double weaver's knot, if well tied, is perfectly satisfactory. A fisherman's knot is less prone to slip, but reduces the breaking strength.

No difficulties have been experienced in weaving tyre cord fabrics when rayon has been used. The soft cotton weft 2 or 3 picks per inch is, of course, still retained. There is, too, a greater uniformity in the resultant product with rayon, which will be more outstanding when certain difficulties in war-time rayon production are removed.

Although some twist liveliness is present in rayon tyre cords it is not necessary to set this twist by steaming. With certain twist constructions it may, however, be advantageous, and it is interesting to notice that in America a process has been developed, using electronic heating by high frequency currents to provide uniform setting of twist.<sup>3</sup>

#### Adhesion of Cords to Rubber.

Cotton, principally owing to the physical characteristics of its fibres, has excellent adhesive properties towards rubber. Rayon, for precisely opposite reasons has very poor adhesion to rubber. The smooth regular rayon is unable to make a satisfactory bond with rubber without assistance. A great variety of processes fortunately exist which enable rayon to show at least equal and sometimes superior bonding results. Although certain tyre manufacturers through their previous practices, such as gum dipping, have been able to proceed with rayon without difficulty, it must be acknowledged that this bonding problem seriously delayed many manufacturers from experimenting with rayon.

A review of the suggestions for promoting rubber adhesion put forward can be seen in the many patents on this subject. Some idea of the variety of methods proposed can be seen from the following list:—

Free tri-hydroxybenzene (pyrogallol acid)	...	...	...	...	...	U.S.P.2,294,826
Phenol-formaldehyde resin	...	...	...	...	...	U.S.P.2,291,208
Latex + casein	...	...	...	...	...	B.P.480,492
Polymeric 2:2:4-trimethyl-1:2-dihydroquinoline	...	...	...	...	...	U.S.P.2,263,305
Condensation product of rubber and chlorostannic acid	...	...	...	...	...	U.S.P.2,247,923
Soya bean protein solubilised with NaOH or NH <sub>4</sub> OH	...	...	...	...	...	B.P.546,171
Haemoglobin, protein, latex separately	...	...	...	...	...	U.S.P.2,129,623
Mixing adhesive and non-adhesive fibres	...	...	...	...	...	B.P.501,436
Resorcinol formaldehyde latex	...	...	...	...	...	{ B.P.447,380 B.P.507,493
Nitroso compounds e.g. <i>p</i> -nitrosodimethylaniline	...	...	...	...	...	B.P.522,568
Casein latex at high temperatures	...	...	...	...	...	{ B.P.546,171 B.P.433,777
Milling aldehyde or ketone with rubber and applying in naphtha solution	...	...	...	...	...	B.P.523,152
Viscose solution	...	...	...	...	...	B.P.521,108
Phenol, formaldehyde, dimethylamine	...	...	...	...	...	U.S.P.2,211,960
De-acetylated chitin	...	...	...	...	...	U.S.P.2,211,964
Cyanamide aldehyde resin	...	...	...	...	...	{ U.S.P.2,211,949 U.S.P.2,211,948
Emulsion of benzene and water, with protein and water	...	...	...	...	...	U.S.P.2,129,626
Phthalic anhydride.						
Rubber dispersions.						
Rubber dispersion and quaternary ammonium compounds	...	...	...	...	...	B.P.559986

Many other patents embodying variations of the above have not been abstracted.

After considerable discussion in the trade, one of the most popular adhesives adopted was the resorcinol formaldehyde resin in conjunction with latex. A typical formulæ is as follows:—

Pretreatment emulsion for 100 parts.

Resorcinol...	...	1.7%
Formaldehyde 40%	...	3.6%
Caustic soda	...	0.3%
Latex solid	...	15.0% (from 60% emulsion).

This emulsion is commercially available as Vulcabond T. The increase in adhesion is tested by peeling the fabric from vulcanised stock and is expressed as lb. per linear inch, and the following tables show the improvement in bonding by this process.

#### Bonding Rayon Cord to Natural Rubber Carcase Stock.<sup>1</sup>

Strength of adhesive	No. of dips	% dry adhesive	Load to peel lb./linear inch	
			Cold (20° C.)	Hot (95–100° C.)
Strength ... ..	1	10	37.5	28.6
" ... ..	2	13	42.0	31.0
" ... ..	3	18	37.5	28.6

#### Bonding Rayon Cord to Synthetic Rubber Stock.

Adhesion to	Strength of adhesive	No. of dips	% dry adhesive	Load to peel lb./linear inch	
				Cold (20° C.)	Hot (95–100° C.)
Butyl tread ... ..	$\frac{1}{2}$ strength ...	1	12	33.0	12.0
" " ... ..	No adhesive	—	—	22.0	5.5
Neoprene GN tread ...	$\frac{1}{2}$ strength ...	1	11	15.5	9.0
" " " " ... ..	No adhesive	—	—	11.0	0
Hycar OR tread ... ..	$\frac{1}{2}$ strength ...	1	11	14.3	8.0
" " " " ... ..	No adhesive	—	—	9.0	0
GR-S tread ... ..	$\frac{1}{2}$ strength ...	1	12	20.0	9.0
" " " " ... ..	No adhesive	—	—	6.5	0
GR-S carcase ... ..	$\frac{1}{2}$ strength ...	1	14	28.6	Tearing stock at 11.0 Bond not broken.
" " " " ... ..	No adhesive	—	—	6.6	2.2

#### Flexing Tests.

One inch wide samples used for the peeling tests already described were flexed for 60 hours on the du Pont flexing machine and immediately afterwards tested for load to peel. The decrease in resistance to peel was of the order of 40 per cent. Untreated cords separated completely after a few hours flexing. The number of flexures given was approximately  $1.5 \times 10^6$ .

In practice the dipping is performed on a machine similar to a Johnson sizing machine. The roll of fabric is led through an immersion bath containing the resin-latex mixture and through a squeeze roller to remove the surplus liquid. The fabric is then passed round drying cylinders and is batched up on a small diameter roller. During drying, complete condensation of the resin occurs and the fabric becomes a rich red brown colour. It can be seen by examination of the cross section of the cord that the resin latex layer is superficial and is only on the outer surface of the cord. Care has to be taken that the fabric is really dry, that tension is maintained or even increased and that



the width of the fabric is not unduly affected. In this as in similar processes, copper and manganese should be rigorously excluded because of their adverse effect upon rubber.<sup>5</sup> Consequently the usual copper size tank should be replaced by a galvanised tank and brass rollers replaced by steel or rubber covered rollers. Once the operation of "doping" has been started it should not be interrupted as standing on the hot drying cylinders melts the rubber and spoils the effect. Ventilation should be provided to eliminate formaldehyde vapours.

Bonding seems to be due to mechanical locking of the rayon to the rubber by the resin matrix and not to chemical combination. This is in conformity with results obtained by peeling tests of various textiles from a wide range of plastics.

This treatment has no harmful effect upon the strength of the rayon and does not seem to interfere with the flexing properties. Two other processes at present in use consist of pretreating with casein in one instance and with rubber dispersions in another instance.

The necessity for this treatment on rayon is an additional process which increases the cost of using the synthetic fibre, but as tyre manufacturers can incorporate it more or less easily in the normal process, it has not been an unsurmountable obstacle. Whilst the pretreatment of cotton has not been necessary in the past, it must be remembered that by similar methods the adhesion of cotton to rubber is still further increased and already interest in this field is shown by the fact that some patents have been applied for. In one or two instances tyre manufacturers have always pretreated their cords by the so-called "gum dip."

Strong adhesion of the cord to the rubber is very important, otherwise the cords separate under the various stresses and give rise to heat development and failure. In nearly all patents increased flexing values are claimed with increased adhesion, both on rayon and cotton. This process may be of assistance in improving the known poorer flexing properties of cotton compared with rayon.

### **Strength and Elongation.**

High tenacity rayon is an example of a somewhat unfortunate nomenclature in relation to tyre cords. It conveys that the only requirement in a tyre cord, either cotton or rayon, is that of strength. Tyre cords have to be made to definite specifications in which the extension and flexibilities of the cords must also be taken into consideration and the construction of present day cords represents some sort of a compromise between these properties.

If it were simply a question of strength the problem would be simple. It is well known that the insertion of twist has a very important bearing on strength and it has been computed that cotton yarns rarely achieve 50 per cent. of their fibre strength. Fibres united into a thread with a very low twist, have little resistance to pulling due to fibre slippage. The increase of twist is accompanied by a corresponding increase in torsional and compressive forces. These forces increase the frictional resistance at any given cross-section and can be such that the frictional force is greater than the fibre strength, with the rupture of the fibre taking place at the break instead of slippage. This process may be increased until the axial cone is at its maximum and even fibres on the outside can no longer slip. No further increase in strength is then obtained, but a decrease takes place due to torsional stresses and the high inclination of the fibres to the yarn axis. It is known that the strength of the cotton fibre when wet is increased, but it is also true that the fibre becomes less rigid, more plastic and more extensible. The effect of wet stretching cotton cords therefore is to make a more compact thread with a higher strength due to the resultant increase in frictional forces between the fibres.<sup>6</sup> An increase is similarly observed if the cotton is de-waxed.

An increase in strength of twisted yarn can be achieved as follows<sup>7</sup>:—

- (1) Increasing the number of contact points or area of contact with adjacent fibres.
- (2) Increasing the coefficient of friction.
- (3) Increasing binding pressure.
- (4) Improving the strength of those fibres held more securely than required for breaking.

It will be very interesting to see the effect of the new type Egyptian yarns cultivated by Dr. Balls, and although an increase of fibre strength by no means results in increased yarn strength, the phenomenal claims for "Amon" yarns have aroused great interest. New strong American cottons have also been mentioned, but no physical data have yet been published.

There seems to be a great deal of interest in producing cotton cords of higher strengths, but few references are available. B.P.544,796 refers to wet stretching and heat compression, U.S.P.2,297,536 claims increased strength due to treatment with aqueous alkali metal rosinat-silicate solution and American references would indicate interest in softening the natural cotton waxes *in situ* with the help of substances such as sodium alkyl naphthalene sulphonate (B.P.545,716, U.S.P.2,103,218, U.S.P.2,254,740). A brief reference has been made to the treatment of cotton yarn with cuprammonium solution of cellulose to increase the strength.

The effect of twist on rayon is similar in some respects to cotton, that is to say, for the highest strength there is an optimum twist. With rayon as a continuous and smooth filament different conditions apply. In twisting, it is the outside filaments which are ultimately strained the greatest as there can be little slippage of fibres and consequently these fibres become strained and under high torsional forces. There is also no point in increasing frictional resistance. The development of strength at a given twist figure is largely controlled by the strength of the individual filament and its elongation. The solution lies in effecting more complete orientation of the cellulose chains, without loss of too much elongation, as the following table shows and probably in using high quality cellulose (longer chain molecules).

	Tenacity—g. per denier <sup>8</sup>
Viscose rayon, poorly oriented ...	1.7-1.9
" " moderately oriented ...	2.0-2.6
" " highly oriented ...	3.0-3.5
" " extremely oriented ...	up to 5.8

Higher tenacity rayon at present in use for tyre cords may be classed as highly oriented. Rayons which have been extremely highly oriented, including saponified acetate yarns of more than 7.0 g.p.d. have unfortunately very low elongations which have so far rendered them unsuitable for tyre cords.

#### Effect of Moisture.

The effect of moisture on tyre cords is very important. In actual practice cords are embedded in rubber after a drying operation and at elevated temperatures which are necessary to render the rubber plastic. The heat generated during normal running on trucks is stated to be 80-90° C. and above this under certain conditions such as in the case of twin tyres, proximity to brake drums, under-inflation and heavy loads, etc. The substitution of synthetic rubber (Buna S) for natural rubber results in higher temperatures still, so that the cords are functioning under hot dry conditions.

It has been stated to the author that thermo-couple tests taken on tyres after standard conditions of actual running tests have shown that a marked increase in temperature was recorded on tyres containing cotton cords compared with rayon cords. The number of tests taken was sufficiently large to eliminate exceptional results and to give a good average. The tyres (Buna S) were made by the same manufacturer and the only constructional variable was the nature of the cord. There is practically no difference in the heat conductivity of rayon

and cotton, so the increase in temperature was presumably due to the heat of inter-fibre friction. The effect of temperature on the tyre as a whole is probably of as much significance, however, as its effect upon its component cords.

The difference in behaviour is very distinct between cotton and rayon. The effect of water or moisture on rayon results in a decrease in strength due to swelling and it is assumed that the internal cohesion is diminished by the separation of fibre molecules by water molecules. Conversely on drying, a gain in strength is observed on the elimination of moisture and this is more marked in a folded yarn than in the singles yarn. An increase in strength of 25 per cent. may be observed between a rayon cord at 12 per cent. moisture and the same cord at 0 to 2 per cent. moisture. With a cotton cord a marked loss in strength occurs at very low moisture figure. Although the cotton fibre shows a greater strength at high humidities and in the wet state, the reverse takes place in the dry state. The elimination of water results in a fibre shrinkage which must destroy to some extent the cohesion in a twisted yarn between the individual fibres with a lowering of inter-fibre friction, and consequently tensile strength. References to this are numerous, particularly in work carried out by Peirce.

On representative samples of cotton cords and rayon cords the following losses in strength were observed between normal moisture content and 0 to 2 per cent. moisture.

	Total denier	Strength 65% R.H.	Calc. to equiv. count	Bone dry	Calc. to equiv. count
2/ply rayon 2/1180 den. ...	2750	12.5	10.4	16.5	13.8
2/ply cotton 2/3/18s ...	2300	9.0	9.0	7.25	7.25
3/ply cotton 3/4/18s ...	4080	20.0	22.0	15.75	17.7
3/ply cotton 3/5/26s ...	4500	25.25	25.25	20.25	20.25
3/ply rayon 3/1180s ...	4420	15.5	15.8	22.75	23.1

From the simple effect of heat and moisture it is clear that the results are in favour of rayon, but special heat-resisting cottons have been mentioned, produced by spinning and twisting under compression while the gums or pectins are in a soft condition. Remarkable results have been claimed.<sup>9</sup> Busse has stated however that other factors must be taken into consideration such as the effects of temperature alone, different rates of loading, vibration tests, temperature and time, and has concluded that in many instances, part of the failure of cords is due to plastic flow within the fibres. According to results from this source<sup>10</sup> the effect of temperature at a constant humidity (absolute moisture content to give 65 per cent. R.H. at 72° F.) is that this in itself shows a constant difference in favour of rayon between 90 and 180° C. At 90° C. rayon and cotton lose 7 per cent. and 20 per cent. respectively, and at 180° C. the corresponding losses are 20 per cent. and 35 per cent., respectively.

#### Effect of Rates of Loading.

There is little published information comparing the effects of different rates of loading between cotton cords and rayon cords. It has been stated (Castricum and Benson) that the tensile strength of rayon was found to vary with the logarithm of the rate of loading, in agreement with the original findings of Midgley and Peirce on cotton. The normal stress-strain diagram of rayon at 65 per cent. R.H. shows a distinct yield-point, but this is much less noticeable at very high rates of loading, such as a few tenths of a second with a breaking tension as in the Ballistic test. This phenomenon is described as being due to reinforcing effects concerned with the viscosity of the fibre. Under the effects of very high rates of loading, both cotton and rayon show higher strengths and the ability to withstand sudden shocks. If this stress is plotted (at normal testing

speeds) as the ordinate and the strain as the abscissa much information can be gathered by a study of these curves. If the curve bends towards the ordinate, the fibre reinforces itself, but on the other hand, if the curve bends towards the abscissa it means that the internal structure of the fibre is weakened and plastic flow takes place. Under these conditions high tenacity rayon shows a greater work potential than cotton. It is reasonable to assume that at high rates of loading and at high temperatures the results will be in favour of rayon. So far there are few published data on these points, particularly at zero or low relative humidities.

#### Effect of Vibratory Loading (Cyclic Stresses).

One of the most characteristic phenomena in a tyre under running conditions is the wide range of stresses imposed on the tyre cords. These are subjected to continuous and variable loads and it has been contended that the only nearly constant stresses of normal testing methods do not reveal sufficient data to explain the failure of cords. A machine has been devised (U.S.P. 2,240,505) which can be used to examine the effects of cyclic stresses under different loadings and different temperatures. Briefly, the cords are suspended from an upper bar, which is vibrated with a regular stroke and weights are hung on the lower ends of the cords. The cords themselves may be heated to the desirable temperature by means of an electrically heated oven. It has been shown that losses in strength occur which are not due to chemical degradation through heat and the failure at high temperatures is thought to be due in part to plastic flow of the fibres.

In these results, it is shown that resistance to fatigue under various conditions of load and temperature decreases more rapidly in cotton cords than rayon cords, when cords of equivalent original strength are taken.

One interesting table shows that the life of cotton cords under these cyclic stresses is less than that of rayon at high temperatures.

					Life of cord in hours	
					Cotton	Rayon
First break	...	...	...	...	0.5	11.0
10%	...	...	...	...	3.4	16.2
25%	...	...	...	...	5.2	17.8
50%	...	...	...	...	8.0	19.2
75%	...	...	...	...	11.4	21.7
90%	...	...	...	...	16.0	24.1
Last cord	...	...	...	...	36.6	30.0
Average	...	...	...	...	8.8	18.5
Standard deviation	...	...	...	...	3.8	3.5

#### Effect of Flexing.

In any discussion on the testing of tyre cords, no subject seems to cause greater controversy than flexing tests, because a machine is not available which will faithfully reproduce all the various flexings and stresses which occur in a running tyre. When all these phenomena are better understood it will no doubt be possible to build a machine which will predict with comparative accuracy the performance of a particular tyre cord.

Machines have been constructed for flexing cords alone or embedded in vulcanised rubber, either at normal atmospheric temperature and conditions or at elevated temperatures with very low humidities. U.S.P. 2,291,086 described an apparatus for imposing cyclic bending stresses on a flexible yarn or strip of material without abrasion. This consists of supports between which the yarn is held under tension and a group of rotatable rollers around which the yarn is looped, the group also rotating as a whole to flex the looped portion of yarn continuously under tension. The author has had experience of only one type which may be briefly described as follows:—

The machine is intended to reproduce some of the forces exerted on a cord which takes place in a tyre rolling on a smooth surface under load. A constant

tensile stress due to the inflation pressure within the cover is represented by a weight hanging on the cord.

The bending or flexing stress is reproduced by bending the cord round two smooth glass or metal rods. The cord to be tested is guided round a freely rotating grooved wheel and round two stationary glass or metal rods set equidistant below dead centre of the pulley. By means of a reciprocating crank the pulley describes an arc and by the geometry of the machine the two moving portions of the cord are truly parallel, thus allowing no longitudinal movement of the cord. It is very important that no visible movement of the cord takes place at the flexing rod otherwise abrasion develops and the cord fails for other reasons than flexing fatigue. In any case it is advisable to examine the broken ends periodically by microscopic inspection which shows a characteristic jagged fibre end if abrasion has taken place. The flexing angle is one of personal choice to some extent, but one of about  $30^\circ$  is employed on the machine described, and the oscillation rate is about 600 per minute. Vibration must be reduced to the minimum otherwise the danger of synchronous effects may result in high dynamic forces which seriously interfere with the test. The scattering range of the results is rather wide, but it is possible to deduce reasonably average values. The flexing values or numbers of cycles is affected by the tension, temperature, humidity, rate of oscillation per minute, and by the twist. The effect of twist upon strength and flexing is well demonstrated in the following table of figures in B.P.512,002 :—

Table A

Sample No.	Deniers	Twist per inch	Relative flexing values	Tensile strength in pounds
1	4980	19L : 10½R	100	17.0
2	4760	16L : 10½R	33	20.3
3	4580	13½L : 11R	11	20.1
4	4450	10½L : 11R	8	21.1
5	4660	19L : 7½R	47	18.1
6	4570	16L : 7½R	32	21.1
7	4400	13½L : 7½R	5	21.9
8	4320	10½L : 7½R	6	23.5
9	4580	19L : 5R	53	16.6
10	4500	16L : 5R	36	20.7
11	4330	13L : 5R	9	21.3
12	4240	10½L : 5R	4	23.9

Table B

Material	Construction	Twists per inch	Average flexing cycles to break
Rayon 1... ..	1500d/3	18L ; 9R	164,418
„ 2... ..	275/5/3	4L ; 20R ; 10L	122,063
Cotton ... ..	23's/5/3	20R ; 20R ; 10L	6,393

From this table, it is possible to see that one cannot obtain maximum strength and flexibility simultaneously and that a compromise has to be made. There is also another limiting factor which has to be taken into consideration and that is the effect of cord extension at break as this has an important bearing on the growth of the tyre. This extension is partly controlled by the twist, so that various limiting factors occur. Preliminary tests seem to show that extremely highly oriented rayons show no advantage over highly oriented rayons, if loaded with weights proportional to their strengths. The principles underlying flexing seem to be mainly ability to withstand repeated extension and compression of the single fibres or filaments (sometimes denoted as toughness) and interfibrillar friction. With rayons, that is continuous filaments, the greatest strain is taken by that part of the filament which is farthest away from the axis and which describes the greatest arc. These filaments are observed to break during a flexing test. With cotton cords, the very fact that

they are made up of discontinuous fibres seems to be the cause of their relatively poor flexing properties. These values are enhanced for rayon in hot dry conditions and diminished for cotton. Published information indicates a superior flexing power in rayon, which to date, is well in advance of anything obtained on cotton cords. Various types of machines are in use; and whilst the methods are empirical and open to many criticisms they do at least provide comparative data between rayon and cotton cords. Some machines used for testing do not depend on flexing movements at all, but subject the cords to repeated extension under gradually increasing rates of loading and such machines certainly incorporate some of the phenomena present during flexing. Here again rayon is superior, particularly at high temperatures.

#### Effect of Extension.

In order to control the growth of the tyre, it has already been stated that the ultimate extension of the cord is an important factor. It was this fact which led to the inception of the so-called low stretch cotton cord. In reality it is highly stretched, but it has a low extensibility. This stretching, which takes place with cotton in the wet state has in general a beneficial effect upon the performance of the cord. The strength is improved and the flexibility enhanced. With rayon the effect of stretching is similarly beneficial. There is an increase in the degree of orientation. Within certain limits, flexing resistance does not suffer, but may actually be improved. Serious overstretching, however, will result in a decrease of flexing resistance and ultimately to ruptured filaments. Specifications of the gauge of the final cord (diameter in inches) are also imposed by the tyre manufacturers and these must be taken into account.

#### CONCLUSIONS.

There has been no scientific information published, for obvious reasons, comparing the performances of rayon or cotton cords in similar tyres running under similar conditions.

It is known generally that the U.S.A. production of rayon yarn for tyre cords has been increased to 240,000,000 lb. and that rayon is being used in ever increasing quantities in this country. Presumably there is sound reason behind this, but there is no doubt that the substitution of synthetic rubber G.R.S. is partly responsible. The information in this paper deals only with the behaviour of cords and fibres and there seems evidence to show that rayon is superior to cotton.

The future should be interesting. Technical improvements in rayon and cotton are bound to follow as soon as we know precisely what are the relevant factors dominating the life and durability of a tyre. With the limited facilities at present available to British rayon spinners, much creditable progress has been made, and more will certainly be made in the future. The tyre-cord doublers of Lancashire have developed rayon splendidly and will continue to improve their cotton cords. Research on cotton and rayon is necessary and co-operation between the spinners, doublers and tyre manufacturers is essential. Standardisation of testing is already overdue, and although this has been tentatively discussed, no real progress is forthcoming.

The relative importance of rayon and cotton in the future is difficult to assess. It is certain that rayon has come to stay and no doubt financial considerations are important. We can speculate on natural and synthetic rubber, cheaper rayon and cheaper cotton, but no one will be able to be certain until the essential technical knowledge has been gained in order to form a sound basis for healthy commercial competition.

#### DISCUSSION

*The Chairman* : I think we have heard one of the most complete papers that we have had in this series of lunch time talks. The meeting is now open for discussion.

*Mr. Fletcher Chadwick* : I should like to ask the lecturer if he considers that rayon would have come into the field for tyres as it has done if we could have got natural rubber? On the other hand is it possible that we shall have synthetic rubber instead of natural rubber as a consequence of the information that is now available about

the former? It seems to me that there is something about synthetic rubber—I think Mr. Scholes mentioned it—that has increased the necessity for rayon, but I would like to know if he thinks that we shall have synthetic rubber afterwards or will the tyre people go back to natural rubber?

*Mr. Scholes*: I am not an expert on rubber, but I should say that so far as the tyre manufacturers are concerned the advent of synthetic rubber has been a great difficulty. I have no doubt that it will be improved, but natural rubber is really a first-rate product and there is no doubt it will come back again. The difference between rayon and cotton is less marked with natural rubber than with synthetic rubber. I do not think that in the ordinary type of commercial car—the private-owner car—there is any point in using rayon. I think for the bulk of the trade cotton is perfectly satisfactory. But there are trades where heavy tyres are in use under very severe conditions where rayon will definitely give a better result, even with natural rubber. They will give longer mileage. One other point, rayon cords preserve the carcass so that re-treading can be done more frequently. In considering the length of the life of the tyre, I am sure this can be prolonged in tyres running under heavy loads, if rayon cords are incorporated, but I do not see much outlook for rayon on ordinary small passenger cars. On 'bus tyres, heavy duty tyres and aeroplanes I think there is little doubt that rayon will hold its own.

*Mr. Slater*: I would like to ask a question regarding adhesion to either rayon or cotton threads. When you are dealing with a flat piece of cloth like aero fabric you find a nap surface. On cotton fabric rubber bonds itself to the surface more than it does to rayon fabrics, and the reason given is there are so many protruding fibre ends from the cotton and they act as locking points. If that be true, the use of continuous filament rayon, it appears, is against proper adhesion. In the case of aero fabrics better adhesion has been obtained by the use of plasticisers, but the point about a plasticiser is that it never stays put and in time eventually leads to deterioration. Is this protruding fibre end really an important factor in the adhesion of rubber to textile thread?

*Mr. Scholes*: In the case of cotton that is the reason why it sticks. During the preparation of this paper I came across a reference where one worker had experimented with sticking all kinds of fibres to all kinds of plastics. He came to the conclusion that it was simply characteristic of the roughness of the material. I think that is the only reason why rayon does not bond so well as cotton. It has been stated that the natural cotton waxes assist adhesion, but the effect can only be small compared with the natural roughness of the fibre. The roughness supplied by the convoluted fibres in the case of cotton is put on the rayon by the use of a resin. Increased bonding of cotton to rubber can similarly be obtained by treating the cotton with bonding agents. With regard to plasticisers, I do not think that the quantities used in the normal rubber mix are significant.

*Mr. Slater*: You mean that within the normal life of the tyre deterioration it is not likely to happen?

*Mr. Scholes*: No.

*Mr. Fletcher Chadwick*: Why do we not use staple fibre instead of filament?

*Mr. Scholes*: If we used staple fibre we are still faced with a smooth filament. Cotton fibre with all its convolution is different from staple fibre. Staple fibre would not give the same strength of cord and it would still have to be treated with a bonding agent.

*Mr. Noble*: Have you any information about the use of rayon in tyres besides the use of rayon cords? Have rayon fabrics been used for the jacket in place of the cotton ones and if so have they shown any advantage?

*Mr. Scholes*: Cord fabrics are substantially cords in so far as the tyre trade is concerned. Some firms use fabric and some use cords, but this so-called fabric is simply a collection of cords held together by two picks per inch of cotton weft and these picks are ultimately broken deliberately after coating with rubber. While one may start with fabric in a tyre it ends as a collection of cords.

*Mr. Noble*: I am interested in this question from the point of view of transmission belting made from rubber fabric which has in its interior cords of the tyre cord type. I am wondering if there is any information about the use of rayon fabrics for the external jacket?

*Mr. Scholes*: I am sorry I have no information to give on the question of belts. It has been looked at but we have had enough to do—at least I have—to deal with yarn for tyres. We are looking at this problem but I have no information to give.

*Mr. Towers*: In regard to this high stretched rayon spinning, I believe it is a fact that one of the troubles with the Lilienfeld spinning was the small elongation at the yield point, i.e., the low elasticity of the yarn. What is it like in the case of tyre cord and has lack of elasticity any effect upon the ultimate cord so far as the tyre manufacturer is concerned?

*Mr. Scholes*: In Lilienfeld yarn the elongation is very very low. It does bring up an interesting economic proposition. Assuming you have a very strong rayon as in the case of extremely oriented rayon threads you should get a strong fine cord and although this rayon might cost more you should require a lesser number of cords, so that economically it would be satisfactory. But the result is that with cords made from yarns which have such low extensibilities, extra twists are necessary to give satisfactory flexing

values and in doing this the strength of the cord is reduced to that of a normal highly oriented cord. One is therefore no better off.

*Mr. Towers* : I wasn't referring to elongation, I was referring to elasticity.

*Mr. Scholes* : In so far as elasticity is concerned, both for cotton and rayon, this is very small and I do not think it plays a significant part. The elasticity of the cord is obtained in the twisting process. I do not think elasticity of the fibre has any real practical significance and I would not put it forward as a point in favour of rayon.

*Mr. Fletcher Chadwick* : Surely the success of Nylon tyres is due entirely to this elasticity.

*Mr. Scholes* : Nylon is quite a different fibre, with a much higher elasticity.

*Mr. Rose* : Do you not think that one advantage rayon has over cotton is that the rayon cord is much more compact and therefore you could get in more textile per unit volume and if more textile per unit volume increased the life of a tyre that would be an advantage. You will never be able to get cotton down to the same density.

*Mr. Scholes* : Two-fold 1,180 denier yarn gives a final count of 2,500 denier and cotton cord originally in use was 4,500 denier and that was how the saving in rubber happened but nowadays cotton and rayon cords are made to precisely the same diameter.

*Mr. Fletcher Chadwick* : I think I can answer that question. We have compressed cords in such a way by twist, stretch, pressure and so on that we have got them to equal rayon. In fact we did it before we had rayon. We only compared it with rayon when rayon came along. We are actually giving the same density. It is not an experiment. It is an accomplished fact.

*Mr. Rose* : I would like to make some observations on the use of Lilienfeld yarns which I do not think have yet been adequately brought out. One of the things you have to realise is that Lilienfeld yarns have relatively low resistance to sheer and if cords are constructed of normal construction but made from Lilienfeld yarn they do not in fact realise the strength they had in the single. They are weaker than is realised. That means you have to reduce twists to something of the order of four and five per inch. If you do that you have a very bulky cord and I believe it is found by the rubber people that the flexing life is lower. You cannot achieve a satisfactory flexing life without a high twist as such. That is one of the reasons why Lilienfeld yarn in spite of its great strength has not succeeded in breaking into this field. With regard to elasticity, elongation at the yield point of Lilienfeld yarns is low but the stress at the yield point is higher with ordinary rayon. It is untrue to say Lilienfeld yarn is less elastic. It is true to say it is less extensible.

*Mr. Scholes* : I do not wish to say it is less elastic but only that in this connection it was not of great importance. It has failed so far as flexing is concerned. The subject is only in its infancy and I am sure we have a lot to learn and we shall find a way of making these high strength fibres suitable for tyre cords. This paper is only on progress from 1939 to 1944.

*Mr. Rose* : I wonder nobody has taken up this subject of the prolonged effect of heat on the cords. Statements have been made, some of them quite wild—I have not been entirely innocent myself in this respect—of the heat resistance of rayon cord. Well, Mr. Scholes mentioned that he thought that the actual strength at the high temperature was more important for the tyre as a whole than the effect of degradation on the cord at high temperature. I would like to say that the figures he gave us on the strength at 180° C. are quite outstanding and obviously he could not have heated them for very long. If he had put the cords through the sort of life they would have had at 180° C. in the tyre he would have found the loss was very much greater. Can he tell us how long was the actual test at that temperature?

*Mr. Scholes* : I am quoting from an American source. It is perhaps typical of many methods of testing. One of the factors is acceleration of test conditions to obtain results quickly. I have quoted loss of life at 180 degrees centigrade which I admit is very high but is purely experimental in order to get results quickly and to show if the comparison still holds. I have tests myself going on both in cotton and rayon and both endure temperatures of 104° C. for a very long time but they are not completed yet. But the figure of 180° C. is probably too high.

*Mr. Heywood* : I am very familiar with this problem of tyres being a tyre manufacturer, but there are tyres supplied to the British Army which have to be guaranteed to run at 140° C.

*Mr. Scholes* : That statement by Mr. Heywood would confirm that the experimenter had gone a little too high but that the range of his experiments was not too improbable.

*Mr. Heywood* : I would add that the breakdown temperature of these tyres is on reaching a temperature of 350° F.

*Mr. Scholes* : I am not a tyre expert. I am dealing with the majority of tyres which I believe run at about 100 to 130° C.

*Mr. Heywood* : That is correct.

*The Chairman* : I call on Mr. Fletcher Chadwick to move and Mr. Maldwyn Jones to second a vote of thanks. I personally know nothing of cotton cords nor the process



of tyre manufacture. I feel it is full of pitfalls for the unwary and there is less conflict of information between the cotton and rayon producers than I thought there would be. We have heard very little in defence or appreciation of cotton. I think the tyre cord manufacture might be dealt with in a subsequent talk by somebody who can speak about tyre manufacture. It looks as if we have something on production of tyre cords and what we want to follow is something on utilisation of them.

*Mr. Fletcher Chadwick* : I am very pleased to have this opportunity of proposing a vote of thanks to the lecturer, Mr. Scholes, because in this case we have had a lecture which is to my mind well above the average (Hear, hear). He has treated this subject in a very masterly fashion. I appreciate everything he has done in every way because he has gone into it apparently with an open mind. I rather expected we should get rayon, rayon, rayon and no appreciation of cotton, but Mr. Scholes evidently has a broad enough vision to see that there are good points still in cotton and that it will still have a useful purpose. To my mind he has brought out the fact that owing to the increased demand on cotton it is necessary to start off with some other material which will stand these higher temperatures. There is one thing I would like to know and that is what happens to the deteriorating effect of heat on cotton versus rayon, because information I have got from America definitely states that the deterioration of repeated heating and cooling on rayon after the considerable number of repeated heatings and coolings which take place in the tyre is something like 35 per cent. greater deterioration in rayon than in cotton. The point where the cotton overtakes the rayon by repeated heating tests is a matter I would like going into a little further perhaps when he gets back to his laboratory. I cannot do better than state how well pleased I am that I have come to this discussion to-day. It has been quite refreshing. It has been to the point and I do not know a lecturer who could have treated the subject better. (Applause).

*Mr. Maldwyn Jones* : The rubber industry to-day is passing through perhaps the most interesting phase in its history and one of the arguments is between the rubber growers and the synthetic manufacturers. We imagine the same thing is going on in the textile trade between rayon and cotton manufacturers. As a rubber man I am disappointed in this meeting. I am not disappointed in the lecture. We have had a very detailed and comprehensive lecture on the subject. I knew Mr. Scholes was busily engaged on the subject and this paper has shown how thoroughly he has gone into it. Knowing Mr. Scholes' interest in rayon, he has put things in such an extremely fair manner. But before seconding this vote of thanks I would like to call the attention of the textile people to the American rubber journals and the great political fight in America on this subject and the report of the Trueman Committee last year would give food for thought to both sections. I have no doubt that the cotton section has already learned it by heart. I have great pleasure in seconding the vote of thanks.

*Mr. Scholes* : Thank you very much gentlemen. As I seem to have been rewarded for being fair I would like to be fair to the end. Mr. Chadwick's reference to the heat resistance of cotton was covered in my paper. Heat resistant cottons are on the way. With regard to Mr. Chadwick's remarks about the effect of temperature on cords in tyres, I must point out that there are many factors involved in this case. I have just extracted information regarding the effect of heat alone on the tyre cords.

The author wishes to thank the Directors of Messrs. British Enka Ltd. for permission to publish this paper.

Acknowledgment is also made to Messrs. Henley's Tyre & Rubber Co. Ltd. for permission to publish details of the flexing machine described in this article.

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## TEXTILE TERMS AND DEFINITIONS

The Textile Terms and Definitions Committee has approved the following list of definitions and notes for publication. The terms will be considered again after a period of two months, and in the light of any relevant comments and criticisms which might be received. Readers are invited to send comments on any of the definitions and notes, or to submit for consideration textile terms which in their opinion require clarification. Communications should be addressed to the Acting General Secretary.

### TENTATIVE LIST, NO. 5 (October, 1944).

#### **Carbonised Rag Fibre.**

- n. The animal fibre recovered by the carbonising process whether wet or dry.

*Note.*—Wool or hair recovered by the wet process is sometimes known as "Extract".

#### **Carbonising.**

- n. A chemical process for eliminating cellulosic matter from a mixture with animal fibres by degrading the cellulosic material to an easily friable condition.

*Note.*—The process involves treatment with acid, as by the use of hydrochloric acid gas (dry process) or sulphuric acid solution (wet process), followed by heating.

#### **Carding.**

- n. The reduction of an entangled or matted mass of fibres to a filmy web by working between two closely spaced relatively moving surfaces clothed with sharp points.

#### **Cloth.**

- n. A generic term embracing all textile fabrics and laminar felts.

#### **Count of Yarn (U.S.A., number).**

- n. A number indicating the weight per unit length or the length per unit weight of a yarn.

*Note.*—Various counting systems using different units of weight and length are in use (*see* B.S. No. 947—1941), so the system used must be stated in any precise description of a yarn.

#### **Dent.**

- n. The unit of a reed comprising a reed wire and the space between adjacent wires. Hence also a wire or a space according to context.

#### **Extract.**

- n. *See* Carbonised Rag Fibre.

#### **Felt.**

- n. A textile material characterised by the densely matted condition of most or all of the fibres of which it is composed.

*Note.*—Two broad classes of felt can be distinguished (1) materials having a woven fabric base, and (2) unwoven materials, consisting principally of animal fibres, relying for their construction upon the ability of the constituent fibres to mat together to form a composite body with neither warp nor weft.

#### **Gut Thread.**

- n. A thread incorporated in a woven, knitted or braided structure primarily for the purpose of limiting its extension.

*Note.*—In some sections of the industry it is customary to use the term "gut thread," not only in the sense stated above, but also in reference to threads incorporated in a fabric "for the purpose of increasing its weight, bulk, firmness, or the prominence of the design." (*See* definition of "Wadding Thread"). But because the essential purpose of such extra threads differs so fundamentally in the two cases, it is

desirable that they should be characterised by different terms descriptive of their functions, as here recommended.

### **Hair.**

- n. Animal fibre other than sheep's wool or silk.

*Note.*—It is recognised that this definition implies a distinction between sheep's wool and the covering of other animals, notwithstanding similarity in their fibre characteristics. Thus the crimped form and the scaly surface are not confined to sheep's wool. It seems desirable in the textile trade, however, to avoid ambiguity by confining the term wool to the covering of sheep and to have available a general term for other fibres of animal origin. Normally the less widely used fibres are known by name, e.g. alpaca, mohair, etc., but collectively they should be classed as hair. A difficulty arises when it is desired to distinguish between the fibres of the undercoat and the remainder of the fleece; for instance between the soft short camel hair used for blankets and the coarse long camel hair used for belting. The term wool is sometimes used for the shorter fibre, but it should always be qualified by the name of the animal, e.g. cashmere wool.

### **Pick.**

- n. (1) A thread or group of threads of weft inserted during one revolution of the crankshaft of the loom, i.e. between one beat-up and the next.  
(*Local, shot.*)

*Note.*—Under this definition, a loop of weft, laid across the warp by means of a shuttle or other form of weft carrier, constitutes one pick; so also does a group of threads, whether these are assembled for weaving on the same weft package, or whether they are drawn from two or more packages supplying or carried by the weft inserting medium.

With certain structures, such as  $2 \times 2$  mat or basket weaves, it may be impossible to tell from a sample how it has been woven, and hence how many picks per inch it contains, unless the sample includes one or both selvages.

Where two or more ends of weft are to be woven into the fabric simultaneously, it is recommended that the weaving instruction should be stated as e.g. "22 picks per inch of 24s cotton, 7 ends together." Where, as regards the body of the fabric, but not as regards the selvages, two or more ends or groups of ends of weft are to be in the same shed, it is desirable to avoid any possibility of misunderstanding by describing the fabric as having, e.g. "30 picks per inch (15 double picks) of 9s/3 cotton."

### **Picks per inch, finished.**

- n. The number of picks per inch in a fabric when no further processing in the piece is contemplated.

### **Picks per inch, in loom.**

- n. The number of picks in one inch of cloth counted at an agreed position in the loom, usually between the fell of the cloth and the take-up roller, when the cloth is under weaving tension.

### **Picks per inch, loom state.**

- n. The number of picks per inch in a fabric after it is relaxed from weaving tension, and before any further treatment that may modify its dimensions.

### **Twill.**

- n. (1) A weave repeating on three or more ends and picks and producing diagonal lines on the face of the cloth.  
(2) A cloth produced as above.

### **Wool.**

- n. The fibrous covering of the sheep (*see note on "Hair"*).

**The case for "rayon" as a generic term for man-made fibres.**

It is generally the custom when writing an introduction to the history of man-made fibres to begin with Hooke's prophecy in 1665 that man might find a way to spin a filament resembling silk. Most introductions then proceed to record the fact that by 1920 "artificial silk" had been produced from such diverse raw materials as cellulose, gelatin, casein, real silk, milk, ossein, fibroin, albumin, alginic acid and polyvinyl compounds. (See especially Süvern: "Die künstliche Seide".)

When these materials came on the market, it was the practice to call them "artificial silk," a term that easily slipped into the loose expression "art silk." Within a few years it was felt in many quarters that the practice should be checked. Silk manufacturers and merchants disliked the association of the new materials with their ancient industry, and, as improved varieties of the new filaments were developed, their producers felt that they should be freed from the implications of inferiority and make-shift attached to such terms as "artificial" and "art." In fact, the new materials were worthy of a distinctive name. In 1924 the National Retail Dry Goods Association (U.S.A.) appointed a committee to select a name to replace "artificial silk", and Kenneth Lord of Galey & Lord Inc. proposed "rayon" which was accepted. Later, the Council of the Silk Association of Great Britain and Ireland, Inc., officially approved the adoption of the word "rayon" in place of "artificial silk," and in many important quarters this lead has been followed. Inasmuch as the known forms of artificial silk at that time included filaments spun from cellulose, proteins and organic chemicals that could be synthesised in the laboratory, it may be assumed that the name "rayon" was adopted to cover all types of man-made textile filaments.

The convenience of a simple, single word to cover all types of man-made fibre is obvious. It fits so well into such expressions as "rayon department," "rayon loom," "Rayon Handbook," "Rayon Textile Monthly," and "rayon excise duties," where the interests of the directors, machinists, authors, publishers, or fiscal authorities, as the case may be, include all man-made fibres, and where it may be required to draw a distinction from natural fibres. The only alternative to a convenient word like "rayon" is the term "man-made fibres," which does precisely define the materials, but is clumsy, and has three words where one is desired.

The term "synthetic fibres" has also been used for a long time, and in recent years has become common, though it offends the susceptibilities of pure chemists. To the chemist, a synthetic substance is one that could be built up, by following known ways, from its simple elements, and this can truly be said of some newer types of man-made fibre. There is a tendency, however, to use "synthetic" in a wide sense to cover any chemical that can be built up from simple units or even any product that is manufactured by the chemist. The application of the term to cellulosic filaments is to be deplored, then, for two reasons: first that the molecular structure of these products represents a degradation of the parent molecules rather than a building-up of larger from smaller units, and secondly because it is contrary to the mind of chemists to regard the conversion of a complex natural product into a complex laboratory product as a "synthesis." The term "synthetic fibres" could not, therefore, be an inclusive term for man-made fibres, but it might serve conveniently to distinguish those made from simple organic chemicals from those derived from cellulose, proteins and other plant and animal products.

Since the production on the large scale of the truly "synthetic" fibres, the step has been taken in the United States to limit the application of the word "rayon" to the cellulosic materials. The result is that textile literature is robbed of the convenience of a single, euphonious word for all man-made fibres and is driven to the necessity of reciting a long list of proprietary and other new names whenever the need arises of referring to the whole group. It is as though the invention of new brass instruments required that the inclusive term

“orchestra” should be reserved to the wood-wind (cellulosic!), whilst the strings (protein!) and other members of the family should always bear their distinctive, individual names.

The advocates of this retrograde step no doubt wish it to be assumed that the newer products are distinct from the cellulosic filaments. There are distinctions, of course, entitling each product to bear its own name, but the similarities are so strong that it is surely justifiable to give them a common family name. They are all obtained, ultimately, from natural products—cellulose, proteins, coal, etc.; they are all produced by a continuous extrusion or drawing out of a viscous solution or melt; they are wound and processed fundamentally by the same machinery into cords, fabrics, hosiery and so forth; and the art of the dyer and finisher is applicable to all of them.

Already it is possible to break down the artificial barriers in a most decisive way. Casein may be dissolved in alkali, added to viscose, and together spun into filaments. Cellulose acetate and superpolyamides may be melted together and spun into filaments. What family name are these mixtures to bear? If the proportion of the ingredients is to be decisive, who is to define the limits and devise an analytical control test?

The Textile Institute therefore confirms the application of the word “rayon” to all man-made fibres because:—

- (1) It is a convenient and euphonious expression.
- (2) It is historically justified.
- (3) The similarities in methods of production, processing and utilisation of all the known types warrant the use of a common family name.
- (4) The classification of filaments obtained from mixtures of spinning masses would be hopelessly confusing without a common family name.

## General Items

### Conference on "Dust in Cardrooms"

As announced in the September issue of the *Journal* a conference has been arranged on the subject of "Dust in Cardrooms," to be held at the Midland Hotel, Manchester, on Saturday, 18th November, 1944. The conference will commence at 10.0 a.m. and there will be both morning and afternoon sessions. The proceedings will be devoted to discussions on various aspects of the problem. In order to provide a basis for discussion, several papers written from different viewpoints (medical, scientific and engineering) are in course of preparation and copies of these will be circulated in advance of the conference date, to those intending to be present.

Persons wishing to attend the conference should notify the Acting General Secretary of the Institute not later than the 13th November.

### Institute Diplomas

Elections to Associateship have been completed as follows, since the appearance of the previous list (August issue of the *Journal*):

#### ASSOCIATESHIP

Gathorne Dixon Barrow, A.R.I.C., Chemist and Local Director, Messrs. Flinn & Son, Ltd., Brighton.  
 Victor Castle, Research Chemist, R.A. Establishment, formerly at Gourrock Ropework Co. Ltd., Port Glasgow.  
 Arthur Horsfield Wild, Chief Chemist, Dyeing and Shower Proofing Departments, J. Mandleberg & Co. Ltd., Salford.  
 Brian Henderson Williams, Textile Tester, Manchester Chamber of Commerce Testing House.  
 Reginald Wood, Branch Manager, Edward Ripley & Sons, Ltd. (East), Bradford.

### Institute Membership

The following applicants were elected to membership at a recent meeting of Council:

#### *Ordinary.*

Kaikhusrro Sorabji Amaria, "Vishnu Villa," Station Road, Sholapur, India (Weaving Master, Lakhshmi Cotton Mfg. Co. Ltd., Sholapur).  
 William Campbell Angus, 19, Willowcroft Road, Spondon, Derby (Development and Research, British Celanese Ltd., Spondon).  
 James Clifford Baker, A.M.C.T., 29, Kimberley Road, Astley Bridge, Bolton (Dyehouse Manager, Deakins Ltd., Egerton Dye Works, Egerton, Bolton).  
 Norman Band, "Thornycroft," Birstall, Nr. Leeds (Technical Manager, S. H. Sharp & Sons, Ltd., Grove Works, Leeds).  
 Walter Anderson Caldwell, B.Sc., Ph.D., 14, Pantenville Road, West Kilbride, Ayrshire (Research Chemist, I.C.I. Ltd., Stevenston, Ayrshire).  
 Beslan Cankat, 3, Mount Preston, Leeds, 2 (Student, Leeds University).  
 Charles H. Henkels, Warwick Mills, Laboratory Division, 178, Atlantic Avenue, Boston, 10 (Textile Engineer).  
 Leonard Holt, Egmont, Manchester Road, Rochdale (Cotton Manufacturer, Oswald & Duncan Ltd., Rochdale).  
 James S. Matthew, Denburn Cottage, Southesk Street, Brechin, Angus (Works Manager, D. & R. Duke Ltd., Denburn Works, Brechin).  
 R. N. Srivastava, Delhi Polytechnic, Delhi, India (Lecturer in Textiles).

*Junior.*

D. Finlay Maxwell, John Gladstone & Co., Beechbank Works, Glasgow (at present in H.M. Forces).  
James McCullough, The Deanery, Carrickfergus, Co. Antrim (Junior Flax Grader, Ministry of Supply, Flax Control, 58, Eglantine Avenue, Belfast).  
George Robinson, The Gables, Elland, Yorks (Aeronautical Research).

**Obituary**

It is with regret the Institute announces the death of the following members:

R. BLEASDALE, Blackburn.  
W. LOCKHART, Kirkcaldy.

**Employment Register**

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:

- No. 137—Young man, exempt from military service, requires position as Assistant Manager or Technical Assistant to Manager in Woollen Spinning Mill. City & Guilds Full Technological Certificate in Woollen Yarn Manufacture. Experience in all departments of woollen spinning.
- No. 138—Desires position as Hosiery Works Manager or Assistant Manager. Age 49 years. Technical knowledge of Hosiery Manufacture and Yarn and Fabric testing. 30 years practical experience of Knitting, Mechanics, Foreman and Works Manager. For last 17 years has been Works Manager on plant of fine-gauge fully-fashioned hose and seamless half-hose. Would consider starting up a new plant. Willing to go abroad.

**Vacancies**

One of the largest Hosiery and Knitwear Manufacturers in the Midlands desires to employ a man (graduate, preferably B.Com. or similar) to assist in controlling and developing the qualities and types of their products. Applicants must be constructive with imagination and ability and must have had practical experience in the Textile Industry (not necessarily hosiery). A working knowledge of the different fibres and their corresponding yarns is necessary; also of results obtainable from various dyes and finishes. He must be capable of assimilating information from Trade publications, Patent Office, Research Associations, etc., and of applying it. Consideration will only be given to a man whose qualifications and personality are such as to render him capable of rising to an executive post. Remuneration generous. Men now in H.M. Forces will be considered. Full details, in strictest confidence to Box No. 72.

UNIVERSITY OF LEEDS—Department of Textile Industries. Applications are invited for the post of Assistant Lecturer in Weaving Mechanism (and ancillary subjects) from candidates with both industrial and teaching experience. Facilities available for research. Salary £350-£400 a year according to qualifications. Further particulars may be obtained from the Acting Registrar, Leeds 2, who will receive applications for the appointment up to the 20th November.

## NOTICES: INSTITUTE MEETINGS

### LANCASHIRE SECTION

Friday, 10th November, 1944—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's premises. "Patterning and Colour," by P. O'Brien (Manchester School of Art).

Friday, 24th November, 1944—*Bolton*. 7.30 p.m. Lecture: "The Past, Present and Future of Cotton Spinning Machinery," by G. H. A. Sington (Platt Bros. & Co. Ltd.). The meeting will be held at the new Technical College, Manchester Road.

### MIDLANDS SECTION

Saturday, 25th November, 1944—*Nottingham*. 3.0 p.m. Lecture: "Recruitment and Training for the Textile Industry," by E. M. Gray, M.A. (Cotton Board). The meeting will be held at the University College, Shakespeare Street.

### YORKSHIRE SECTION

Thursday, 2nd November, 1944—*Bradford*. 6.30 p.m. Ladies' Evening. Lecture: "The Clothes Doctor—Some of the Whys and Wherefores of Dyeing and Cleaning," by H. Cunliffe (Turnbulls Ltd., Hawick). The lecture will be held at the Midland Hotel, and will be illustrated by a film. The Ministry of Information will also show one or two interesting and topical films.



# THE JOURNAL OF THE TEXTILE INSTITUTE

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## PROCEEDINGS

### THE BLEACHING OF JUTE FOR TEXTILE PURPOSES

By B. P. RIDGE and A. H. LITTLE.

#### SUMMARY

Details are given of methods that have been found satisfactory for bleaching jute materials to different degrees without undue loss of weight or strength. For mild bleaching, treatment is suggested with cold or warm hypochlorite solutions that are maintained in an alkaline condition. Cold alkaline permanganate followed by a bisulphite clearing process, and hot sodium chlorite under slightly acid conditions also give reasonable results. For better shades a hot peroxide bleach may be given after an alkaline hypochlorite treatment, but for uniformity it is best first to scour the material under mild conditions with a soda ash solution at 65° to 75° C., using about 7.5 per cent. of ash on the weight of jute, whilst still further improvement in shade is obtained if the scouring bath contains a small proportion of peroxide. Other methods that may be used are the ordinary peroxide bleach without previous hypochlorite treatment as normally used for cotton goods, or alternate steepings first in a dilute alkaline hypochlorite and then in a hot solution of sodium hydrosulphite or bisulphite. White or nearly white jute can be obtained only if substantially all the lignin is removed, when the wet strength is seriously reduced.

Information is recorded on the bleaching of yarn in package form and on the processing of mixtures of jute with cotton, linen, wool and rayon.

The behaviour of caustic soda solutions of different concentrations in the woollenising of jute is also illustrated, and finally the need for care in the laundering of bleached jute or mixture fabrics is emphasised owing to mechanical damage that may occur while the material is in the wet, and therefore weak state. Dry-cleaning solvents such as trichlorethylene cause no reduction of strength of either unbleached or bleached jute.

#### INTRODUCTION

The bleaching of jute in such a way as to give a very light shade with small loss of strength presents difficulties due partly to the resistant nature of colouring matter absorbed by the material from the sluggish impure water often used in retting and partly to the chemical and physical structure of the fibres themselves; more especially to the latter. It has been known for many years that several of the common bleaching agents are capable of improving its colour to a greater or less extent, and various processes have been described by Matthews<sup>1</sup> and in patent and other literature, but hitherto no critical examination of bleaching methods as for cotton, linen and other textile materials has been made, nor have conditions been defined that enable satisfactory light shades to be obtained with minimum losses of weight and strength.

By far the greater part of the world's output of jute is used for packing or foundation materials that do not require bleaching; and until recently, wet processing other than dyeing has been practised only on a very small scale. The progress made in improving even the coarsest of materials and in mixing them

with the finer textile fibres, and the increasing demand for dyed goods, however, indicate that greater scope for bleaching now exists and it is necessary that the processing should be done under conditions that allow for maximum retention of the desirable properties of the fibre. The effect of bleaching in permitting brighter shades to be obtained on dyeing is particularly marked. For example, whilst the basic dyestuffs are capable of giving reasonably bright shades on unbleached jute, the classes of dyestuffs with superior light and washing fastness properties, such as the Azoics and Vats, show pronounced increase in clearness and brightness with increasing degree of bleaching<sup>2</sup>. With unbleached or scoured jute the shades obtainable, particularly with vat colours, are dull and "muddy," whereas with a nearly white yarn or fabric they are of a brightness approaching (though perhaps never equal to) that obtained on cotton.

There are various specific purposes for which bleaching may be required according to the uses for which the treated materials are designed, and among them are the following:—

1. To lighten the shade of poorer grades of raw fibre or yarn in order slightly to improve their quality as judged by colour and lustre.

2. To give a better ground in yarn or fabric that is subsequently to be dyed.

3. To enable composite yarns such as jute-wool carpet yarns, jute-flax or other mixed yarns or cloths to be bleached or dyed as nearly as possible to level shades.

4. To give a relatively good white in furnishing and other fabrics composed partly or wholly of jute, thus enabling novel fabrics or effects to be obtained.

5. To provide a white, lignin-free cellulose of high alpha-cellulose content that may be used in processes where bleached wood pulp or purified cotton is normally employed—for example, in the production of rayon and cellulose esters, or in paper manufacture.

Methods of obtaining cellulose of this type have already been discussed elsewhere.<sup>3, 7</sup>

Processes that have now been examined include various combinations of wet treatments with common scouring, oxidising and reducing agents, whilst the effects of a few gaseous products are also mentioned. Some results of earlier work in the investigation have already been recorded, with acknowledgements, in a "Survey of Jute Research" by Barker<sup>3</sup>, whilst others have been referred to by Parsons<sup>4</sup>. Many details having an important bearing on the recommendations are also given in a previous paper<sup>5</sup> to which reference should be made for fuller information on certain sections.

It should be realised at once that the bleaching of jute to a pure white with little adverse effect on strength as with cotton and linen is impossible, owing to the unavoidable breakdown of the natural fibre structure accompanying the complete removal or modification of its coloured constituents. Nevertheless, by choice of suitable methods very considerable improvement in colour can be made and yarns can be bleached to a pale cream with no important loss of dry strength. Such yarns are capable of use for purposes for which the original unbleached material would be quite unsuitable.

### Gas Bleaching

For practical purposes, bleaching with gases must be regarded as of little importance. Some attention has been given to the use of sulphur dioxide and for this reason a few comments on the process are made.

*Sulphur Dioxide.*—By exposing raw jute to a moist atmosphere saturated with sulphur dioxide it is possible to obtain some lightening of the shade but the bleaching effect is only slight. The procedure resembles that employed in the well-known stoving of wool goods in which the gas, obtained from burning sulphur, pyrites or from cylinders, is admitted to a wooden or other suitable chamber containing the material, and is allowed to act for several hours.

The treated fibre is always uneven in shade owing partly to original variations of colour in the bundles from one end of the fibres to the other, and partly

to non-uniform distribution of moisture throughout the load. This uneven moisture content may result from condensation within the chamber and also from uneven distribution of the emulsions used in the previous batching of the jute. The darker butt ends of the fibres always remain substantially unchanged in colour, and owing to absorption of the gas, the treated material is distinctly acid and must be neutralised if tendering is subsequently to be avoided. Neutralisation involves a wet treatment with an alkaline liquor followed by washing and drying, and the extra processing and handling thus necessitated add very considerably to the expense of the process. These disadvantages, together with the smell and corrosive effect of the acid gas on works premises and equipment, are more than sufficient to make the method of little technical importance.

*Chlorine.*—Chlorine by itself is not a satisfactory bleaching agent for jute. It first darkens it and subsequent treatments with alkaline and bleaching liquors are required if a true bleaching effect is to be realised.

*Chlorine Peroxide.*—This gas has a more pronounced bleaching action on moist jute than has sulphur dioxide, but after exposure of moist yarn to an atmosphere of the gas for about four hours at the ordinary temperature only a yellow or reddish yellow colour is obtained and the bleaching action under these conditions cannot be considered good. Chlorine peroxide is generally available only on the laboratory scale and owing to its explosive properties it is unlikely to become of great importance as a commercial reagent. The alternative of using sodium chlorite is discussed in a later section.

#### **Wet Bleaching Processes**

No reagent or process has yet been discovered that is capable of bleaching the coloured cell-wall and incrusting substances without impairing their adhesion to the ultimate cellulose bundles of the fibre or adversely affecting the composite structure of jute, and for practical bleaching purposes it is still necessary to employ the substances commonly used for the other vegetable fibres.

The processes that may be used, therefore, involve treatment of the material with oxidising agents alone, or with various combinations of hot alkaline, oxidising, chlorinating or reducing substances. All such processes remove non-cellulose incrustants and so diminish the strength of the material to a greater or less extent, particularly in the wet state. For this reason handling of wet jute yarns or fabric should be avoided as much as possible. Similar effects of diminution of strength in the wet state are well recognised in the bleaching or other wet processing of rayon, and if for handling purposes bleached jute is considered to resemble rayon, no more difficulty should arise in dealing with it than is experienced with the latter material. The obvious method of avoiding damage to yarns is to treat them in package form in suitable machines as in the cheese or cone bleaching of cotton, linen or rayon yarns.

Success in bleaching jute depends perhaps not so much on which of the common reagents are used as on the conditions employed. For example, it is obvious from the results already recorded<sup>5</sup> that where strength is to be conserved some of the processes often employed for other vegetable fibres, such as scouring under pressure with alkaline solutions, the use of acid hypochlorite and so on, are too drastic in their action because they affect too profoundly the hemi-cellulose, lignin and other incrustants. It is necessary, therefore, to choose conditions that enable the incrustants to be retained to a considerable extent, and processes suitable for bleaching to different degrees are given below.

*Preparation for Bleaching.*—Jute does not wet out easily in aqueous liquids owing mainly to the fact that although its fat and wax content is low, it contains mineral, fish or other oils from the batching operation, and since thorough wetting is essential if uniform bleaching is to be secured either a scouring treatment with a hot alkaline liquor may be given or the material must be wetted out in a solution of a wetting agent. If the agent chosen is resistant to hypochlorite or other bleaching solutions it may be added direct to these liquors. A wetting agent that is unaffected by bleaching powder solutions is Calsolene Oil HS (I.C.I.). The addition of such an agent to bleach liquor is satisfactory

provided that the latter rapidly has access to all parts of the material to be treated. In other words, uniform bleaching depends also on efficient circulation of the liquor throughout the load or on circulation of the material through the solution as in the jig bleaching of cloth or the reeling of yarn. When yarn or fibre lies in a bath without satisfactory movement unevenness can be expected even though a wetting agent is present, and for this reason, where uniform movement of material or liquor cannot be assured, it is better first to wet out the jute in a separate bath containing the wetting agent, then to hydro-extract or squeeze it free from excess liquor and enter it without drying into the bleach bath.

Instead of using wetting agents in the above manner it is also common practice with all vegetable textile materials to scour them with alkali for the double purpose of wetting them efficiently and at the same time removing soluble non-cellulose impurities. From the effects already shown<sup>5</sup> of using alkalis under various conditions it is apparent that when both dry and wet strength are to be maintained the non-cellulose incrustants must be removed only to a small extent and, therefore, mild conditions must be employed. Water alone does not give sufficient cleansing, and for general purposes a treatment for one to two hours at 65-70° C. in a liquor containing about 7.5 per cent. of soda ash on the weight of jute can be recommended. The loss of weight under these conditions amounts to only a few per cent. whilst both the dry and wet strengths of treated yarns are good. With caustic soda in open or pressure boils the loss of weight is much higher and the wet strength is considerably reduced, so that except where very efficient purification is necessary the use of this alkali should be avoided. If specially good bleaching is required and loss of wet strength is not very important provided that the strength of the dry yarn is satisfactorily maintained, the addition of a small proportion of sodium peroxide and silicate to the soda ash scouring liquor mentioned above is of advantage.

*Mild Bleaching.*—For purposes of mild bleaching, where the colour is changed to yellow or light brownish yellow and little loss of strength occurs, a simple treatment in a solution of bleaching powder is sufficient. The concentration of available chlorine may be from 3 to 7 g./l. but if the best results are to be obtained it is necessary to ensure that the liquor is maintained in an alkaline condition throughout the treatment<sup>5</sup>. For this purpose either the bleaching powder solution may be prepared by mixing the required quantity with water and using it direct without settling, or where a settled concentrated stock liquor is kept it may be suitably diluted and milk of lime added to it in the proportion 1½ to 3 lb. of slaked lime per 100 gallons of liquor.<sup>6</sup> During the bleaching the suspended lime gradually goes into solution, but subsequent souring and washing of the yarn or fibre may be necessary for clearing purposes.

Instead of milk of lime, soda ash may be added, but it should be remembered that this substance first precipitates the calcium from the calcium salts as carbonate and it is only after the precipitation is complete that excess of the alkali capable of exerting buffering action can accumulate in the liquor. The proportion of soda ash required depends on the concentration of available chlorine present and on the content of soluble calcium salts in the original solid bleaching powder, but where the bleach bath is prepared by dilution of the usual concentrated stock liquor the amounts per 100 gallons necessary to precipitate calcium and to maintain the alkalinity may be taken as 10 to 12 lb. of ash for a liquor of 3 g. of Av.Cl/l. and 12 to 15 lb. for one of 5 g./l. concentration. Too great an increase in the alkalinity gives a worse rather than a better colour. For example, by the addition of 5 g/l of both soda ash and caustic soda to a sodium hypochlorite solution of 5 g. of Av.Cl/l an initial pH of about 12 is obtained and the colour of jute yarn after one hour's treatment in this liquor is significantly darker than that obtained under similar conditions with a solution at about pH 11 containing 10 g. of soda ash per litre but no caustic soda.

Jute yarn can also be bleached rapidly to a cream shade by using a warm solution of sodium hypochlorite to which has been added either sodium silicate or

soda ash in quantity sufficient to maintain the required alkaline conditions. Both the silicate and the soda ash serve in some measure to stabilise the hypochlorite and satisfactory effects have been obtained not only in a Hussong type machine but also in a cheese dyeing machine.

It is necessary that the temperature should not greatly exceed 40° C. otherwise the bleaching is unlevel. The following results are recorded to illustrate the effects obtained on hanks and cheeses previously scoured with soda ash solution at 70° C.

The hanks of yarn were bleached for one hour at 40° C. in a sodium hypochlorite solution of concentration 5 g. of av.chlorine per litre containing 10 g/l of sodium silicate (wt. ratio  $\text{SiO}_2:\text{Na}_2\text{O}=2\cdot0$ ) using a liquor ratio of 15:1. The material was then washed, antichlored and further washed. The results of tests were:—

	g. Av.Cl./l	pH	Breaking loads, lb.	Loss of weight
Start ...	5·96	11·1	Original, dry 9·0	—
15 min. ...	2·6	10·4	Scoured „ 8·45	—
30 „ ...	1·9	—	—	—
60 „ ...	1·2	10·2	Bleached „ 7·5	8·1%

The same yarn in cheese form was bleached with a solution containing 8 g. of av. chlorine and 15 g./l. of sodium silicate at a liquor ratio of 10 to 1 for 30 minutes at 40 to 45° C. It was subsequently antichlored and washed as usual. The material was of uniform colour throughout the cheese and the results of tests on the bleached material were: Breaking load, dry 7·6 lb., wet 5·1 lb. Loss of weight after both scouring and bleaching 7·5 per cent.

The cold bleaching powder treatment mentioned above is suitable for loose jute fibre where either a lighter shade in the otherwise untreated material is required or a better ground is desirable before dyeing. The bleached jute should be antichlored with a sodium bisulphite solution before being dried otherwise serious tendering will result if the residual hypochlorite is dried on during the usual hot drying process. Owing to the difficulty in removing acid it is generally not advisable to give a final souring treatment unless conditions of time and water supply allow for the prolonged washing necessary to remove the last traces before drying.

*Bleaching to half- or three-quarter White.*—It has already been stated that it is impossible without serious loss of weight and particularly of wet strength to bleach jute to a white or near-white shade, and in all processes to aim at such a degree of bleaching some sacrifice of both these properties must be made. Improvement in colour generally also appears to go hand in hand with removal of lignin and the progressive attack and elimination of this substance as the colour of jute yarn approaches white is shown in Table I, where the effects of bleaching treatments of increased severity are shown.

The whitest sample, No. 8, is seen to have lost over 70 per cent. of its original lignin, but reasonably good bleaching can be secured with a smaller loss as indicated by some of the other samples described. No. 5, with a loss of 12·5 per cent. in weight and 38 per cent. in lignin, was actually darker than No. 4, with losses of only 5·3 per cent. in weight and 28 per cent. in lignin, but no treatment has been found in which significant bleaching occurs without appreciable loss of lignin, and it appears that such loss is inevitable if the coloured non-cellulose incrustants are to be lightened in shade satisfactorily.

Although it is not absolutely essential, an alkaline scour is of advantage as a preparatory treatment before bleaching to good shades because among other things it has a softening effect on the incrustants and enables greater uniformity to be obtained in the subsequent operations. The above mild scour with soda ash (see p. 124) is sufficient, and after washing, a bleach in alkaline hypochlorite of concentration about 3 to 5 g. of av.chlorine per litre should be given for half to one hour at approximately 15 to 1 liquor ratio, whilst for yarn, a reel, cheese or cone

Table I

Treatment	% Loss of Lignin.		% Loss of weight	Colour of jute
	(a)	(b)		
1. Hot water steep, 3 hours at 70° C....	Nil	Nil	2	Similar to untreated jute.
2. Soda ash scour, 10% on weight at boil for 3 hours.	2.4	17	11.1	Darker than untreated.
3. Oxidising scour, 10% of soda ash, 1% of Na <sub>2</sub> O <sub>2</sub> on weight, 2 hours at 65° C.	2.1	15	9.8	Lighter than untreated, but still brown.
4. Soda ash scour, 10% on weight, 2 hours at 65° C. Alkaline chemic 4 g./l, half-an-hour.	3.9	28	5.3	Fair degree of bleaching. yellowish colour.
5. Oxidising scour as (3). Neutral chemic (4 g./l), half an hour.	5.3	38	12.5	Light brown, darker than (4).
6. Oxidising scour as (3). Alkaline chemic (4 g./l), half an hour.	5.1	37	8.9	Good colour, cream, better than (4).
7. Oxidising scour as (3). Alkaline chemic 4 g/l, half an hour, then Peroxide bleach 2.8 g. Na <sub>2</sub> O <sub>2</sub> /l, 2 hours at 65° C., Liquor ratio 30 : 1.	7.2	52	13.6	Very good white.
8. As (7) but with neutral chemic. Liquor ratio 30 : 1.	9.8	71	25	Almost pure white, slightly better than (7).

(a) on weight of original jute yarn, (b) on original lignin content.

(Liquor ratio 15 to 1 except where otherwise stated.)

machine, a Hussong type machine, or an ordinary chemicking cistern may be used. The colour so obtained is usually yellowish cream rather than white. The importance of avoiding acid conditions in this operation has already been emphasised<sup>5</sup>, and the best colour is given by maintaining the liquor in an alkaline condition throughout by means of either lime or soda ash as already indicated on p. 124.

Further improvements to a pale cream can then be secured by means of peroxide. The yarn is bleached for about two hours at 65 to 70° C. in a solution containing per 100 gallons of water 2 lb. of sodium peroxide, 4.4 lb. of sodium bicarbonate and 8 to 9 lb. of silicate (I.C.I. grades J.81 or C.100), or the equivalent of hydrogen peroxide and soda ash. The results of giving a peroxide bleach after different hypochlorite treatments have been already recorded in Table V of a previous paper,<sup>5</sup> where it is also indicated that when a final peroxide steep is given, a neutral instead of an alkaline hypochlorite bleach may be employed with good results, provided that the concentration of available chlorine is fairly low (about 3 g/l) and the liquor ratio does not exceed 15 to 1. (B.P.489,496.)

The sequence alkaline hypochlorite-peroxide has recently been recommended in B.P.533,020<sup>8</sup>, the first stage being of comparatively short duration (5 to 15 minutes). Whilst this time may be satisfactory in certain cases it should be remembered that jute as yarn or cloth is not readily and uniformly wetted by cold aqueous liquids and that without previous scouring or wetting out, or longer treatment with the hypochlorite solution, uneven effects may be obtained, especially when the yarn is in package form.

For further improvement in colour an oxidising scour may be given before the hypochlorite and peroxide stages using 1 g. of sodium peroxide and 8 or 9 g. of sodium silicate per litre with the customary soda ash. The effects of this sequence and of using a neutral instead of an alkaline chemic have already been described, Tables VI and VIII<sup>5</sup>, but it is apparent that the greater purification thus secured is accompanied by a significant further loss of wet strength.

It is a feature of the hot alkaline peroxide bleach, however, that the dry strengths of yarns may be increased above that of the original untreated material owing to the closer setting of fibre on fibre that is then secured, and such increase

of strength has been found for yarns treated not only in hank form in a Hussong type machine but also in cheese form.

The ordinary peroxide bleach as employed for cotton goods may also be used for jute, but although it gives satisfactory results it is generally too expensive for ordinary purposes. The treatments for yarn are best given in an iron kier, boiling pan or vat, fitted with an external tubular heater and pump, but cloth may be bleached throughout on a dye jigger with a wood beck and stainless steel fittings suitable for use with peroxide liquors. Two baths are generally employed, the first being the residual liquor from the second refreshed with soda ash and, if necessary, peroxide. The concentration of peroxide is about 1 g/l  $\text{Na}_2\text{O}_2$  and of sodium silicate 8 to 9 g/l, whilst if the water employed is soft additional stabilisation of the peroxide is secured by adding magnesium sulphate (Epsom Salt) in the proportion 0.25 g/l. The material is scoured for one to two hours at about 65-70° C., drained, rinsed with warm water, and then bleached in a fresh liquor containing 3 g/l of sodium peroxide, 6.6 g. of sodium bicarbonate and 8.9 g. of silicate per litre, or the equivalent quantities of hydrogen peroxide and soda ash. As indicated later, this method may also be used satisfactorily in the jigger for bleaching wool-jute mixed fabrics where the use of hypochlorite solutions cannot be tolerated on account of their adverse action on the animal fibre.

### Permanganate

Neither neutral nor acid solutions of permanganate improve the colour of jute to any marked extent, whilst a hypochlorite bleach following an acid permanganate treatment also gives only a poor result. By the addition of hypochlorite to a permanganate solution, however, it has been stated that better bleaching may be obtained, and the following experiments were made to examine this effect.

To separate portions of a bleaching powder solution containing 3 g. of av.chlorine per litre different proportions of potassium permanganate were added and wetted-out hanks of yarn were bleached in them at 15:1 liquor ratio for one hour at the ordinary temperature. All samples were afterwards cleared in a 1 per cent. solution of bisulphite, washed, and tested, with the following results:—

Table II

	Dry	Wet
Original jute yarn ... ..	6.5 lb.	5.6 lb.
Hypochlorite +0.5 g./l. $\text{KMnO}_4$	6.5 "	5.9 "
" +1.0 " "	6.3 "	5.4 "
" +2.0 " "	6.5 "	6.2 "
" +4.0 " "	7.4 "	5.7 "
" +7.0 " "	6.8 "	5.4 "

With the solution containing only 0.5 g/l of permanganate, the latter reagent was very quickly consumed. With those containing 1 and 2 g/l fair bleaching to a yellowish cream was obtained, whilst the effect was slightly better with the higher concentrations. The strength values must be considered good, but as the best shades were little, if any, better than that produced by an alkaline chemic, where strengths are also good, there seems to be little point in using this more expensive treatment.

With alkaline permanganate solutions, however, a marked bleaching action is obtained in one hour or less, and the shade resembles that given by a peroxide bleach. The results of trials by this method are given in Table III.

Half-lea hanks of an unscoured jute yarn were steeped for one hour at 15 to 1 liquor ratio in solutions containing 5 g/l of both potassium permanganate and soda ash at respectively 20°, 40° and 60°, whilst in other trials solutions 2.5 g/l in both reagents and 5 g/l in permanganate and 2.5 g/l in soda ash were employed at the ordinary temperature. The yarns were afterwards cleared with bisulphite in the usual manner.

Table III

Treatment	Breaking load		Loss of weight
	Dry	Wet	
Untreated ...	8.1	7.0	—
1. KMnO <sub>4</sub> 5 g./l., Soda Ash 5 g./l. at 20° C. ...	6.2	4.4	5.2%
2. " " " " " " 40° C. ...	5.1	4.3	7.3%
3. " " " " " " 60° C. ...	4.5	2.8	9.8%
4. " 2.5 g./l. " " 2.5 g./l. " 20° C. ...	6.5	4.7	5.4
5. " 5 g./l. " " " " 20° C. ...	6.2	4.1	4.9
All for 1 hour at 15 : 1 liquor ratio.			

No. 1 at 20° C. was of a good near-white colour, whilst with Nos. 2 and 3 at the raised temperature the shade was slightly inferior and the losses of strength and weight were greater. With half the concentrations of permanganate and soda ash, No. 4, and the lower soda ash content, No. 5, inferior shades were also obtained. With sufficiently alkaline solutions, therefore, good bleaching is obtained at the ordinary temperature accompanied by little loss of weight, and these conditions may usefully be employed in cases where the method is sufficiently economical.

Sodium Chlorite

This substance, which is now commercially available in America as a flaked solid of yellowish colour containing about 80 per cent. NaClO<sub>2</sub>, is sold under the names "Textone" and "C<sub>2</sub>," the former product being for textile and the latter for wood pulp bleaching. Sodium chlorite has an equivalent chlorine content of 135-137 per cent., and the commercial product is recommended to be used in concentration of about 5 g/l at approximately 80° C. Its solutions in water have an alkaline reaction, but it bleaches to a significant extent only under acid conditions, and the maximum effect is obtained in the immediate neighbourhood of pH 5. At lower pH values not only is the bleaching effect worse but the decomposition of the chlorite is considerably greater, whilst at higher pH both the rate of decomposition and the rate of bleaching are slow.

In comparable experiments hanks of jute yarn were treated at 85° C. in solutions of 4.9g. of sodium chlorite per litre at respectively pH 5.3 and 6.4 the liquor/yarn ratio being 20 : 1. It was found that in order to reach approximately the same degree of bleaching as was secured in two hours at pH 5.3, eight hours' treatment was required in the solution at pH 6.4. The effect of temperature is also marked since at the same pH (5.3) and the same initial concentration of chlorite the degree of bleaching obtained after eight hours at 50° C. was considerably worse than that secured after two hours at 85° C.

No very great loss of strength of jute yarn results from the action of chlorite since even with solutions of concentration 17.5 g. per litre the breaking loads for two different yarns treated for one hour in the boiling liquor at pH 5 were respectively :—

	Original	Bleached
White jute ...	7.3	6.2
Red Tossa ...	5.1	3.9

In concentrations of 5 to 10g. per litre, and at 80 to 95° C. and pH 5 to 5.5, chlorite bleaches jute fairly rapidly to a cream in about one hour. This reagent has no tendering action on cellulose and as it is employed in slightly acid solution, neither souring nor antichlor treatments are necessary after the bleaching. As the solutions are corrosive towards many metals, however, care must be exercised in working on the large scale. Polished stainless steel equipment appears to be reasonably satisfactory and bleaching of textile yarns in cheese form in a stainless steel package machine has been done, with no apparent attack of the metal. Some slight corrosion has been observed, however, at the rough edges of sawn strips of stainless steel after immersion for several hours in a boiling solution containing 7.5 g. of chlorite per litre at pH 5.



Wood equipment may be used, although it is gradually attacked by the hot solutions, whilst earthenware and synthetic resin materials of the bakelite type appear to be satisfactory and may find increasing use with this reagent.

#### **Reducing Agents**

*Sodium Bisulphite.*—Solutions of bisulphite have only a very slight bleaching action on jute. For example, after 18 hours' treatment in a liquor containing 12 g. of the salt per litre at a 50:1 liquor ratio the effect is one of cleaning and change of shade rather than bleaching. If mineral acid is added to the liquor the bleaching effect is slightly better, but single treatments with bisulphite solutions are obviously of little importance.

*Sodium Hydrosulphite.*—Hot 1 per cent. solutions of sodium hydrosulphite produce a rapid lightening of shade, but on drying the yarn the colour deteriorates slightly to a greyish tone, and the final effect is poor. Souring, however, gives a slight improvement.

*Stannous Chloride.*—An acid 1 per cent. solution of this reagent at 30° C. has little bleaching effect.

*Reducing and Oxidising Treatments.*—Following a bleach for half an hour in an alkaline hypochlorite liquor containing 5 g. of available chlorine per litre, treatment of the jute for half an hour with 1 per cent. solutions of bisulphite or hydrosulphite at 50° C., or with a 1 per cent. solution of stannous chloride at 30° C., produces further lightening of the shade to a light fawn with little change in the dry strength of the yarn and with very little further loss of weight. With stannous chloride the shade is yellower than with the other liquors and, as would be expected, the final shades are better if a scoured instead of an unscoured yarn is employed. The reverse process, giving first a bisulphite steep and then a chemic, gives a shade hardly better than is obtainable with chemic alone, and apparently the preliminary action of the hypochlorite on the coloured impurities of the jute is required if the subsequent reducing treatment is to be effective.

By repeated alternate treatments, first with hypochlorite and then with hot sodium hydrosulphite or sodium bisulphite liquors it is possible to produce rapid bleaching to a pale cream shade and this method of using alternately oxidising (or chlorinating) and reducing treatments may be employed to give very good colour.

Yarn bleached to a cream shade with hypochlorite and then peroxide may be further lightened to a very pale cream by treatment with hot 1 per cent. sodium hydrosulphite solution.

#### **Bleaching of Jute Yarn in Cheese Form**

As already indicated, the bleaching of jute yarn in cheese form offers advantages because mechanical damage produced by frequent handling of the weaker wet yarn is thereby reduced to a minimum. Moreover, not only bleaching but also dyeing can be done in the same machine without disturbing the packages, whilst expensive winding into hanks and from hanks to bobbins is avoided. It is essential that cheeses should be soft, and preferably cross-wound, and the machine in which they are treated should be provided with means of reversing the direction of flow of the treating liquors at frequent intervals. Standard commercial machines are usually quite suitable.

One experiment on bleaching cheeses with a warm hypochlorite solution has already been described (see p. 125) and other methods are given below.

A bleach that is satisfactory for all ordinary, including dyeing, requirements, is obtained by using the sequence "Soda ash scour at a temperature below the boil, wash, chemic, antichlor and wash," and with the standard yarn used for most of the present work a light yellow colour that might be termed a  $\frac{1}{2}$  to  $\frac{3}{4}$  white was obtained by the following treatment given in a Staybrite cheese dyeing machine and using throughout a liquor/yarn ratio of 10:1.

(1) Scour with 10 per cent. of soda ash on the weight of jute for two hours at 65° C. (2) Wash with hot and then cold water. (3) Chemic with alkaline hypo-

chlorite (5 g. of Av.Cl/l) for one hour at 15° C. (4) Wash. (5) Antichlor with a 1 per cent. bisulphite solution for 15 minutes, wash, hydroextract and dry. (For many purposes these times of scouring and bleaching with hypochlorite may be halved.)

The colour of the bleached yarn was uniform throughout the cheese, the loss of weight was only 7.4 per cent., and the strengths were very good, thus:—

		Dry	Wet
Original untreated yarn	...	8.1 lb.	7.1 lb.
Bleached	...	8.8 „	6.1 „

A further improvement in colour to a good cream was obtained by giving a peroxide treatment after the scour and chemic, but normally unless a very good bleach is required this further stage is probably unnecessary.

Two batches of yarn were given the same treatments except that in the one case an alkaline, and in the other a neutral chemic was employed. Both chemics were of the same initial concentration (5 g. of Av.Cl/l) but the alkaline liquor was used for one hour whilst the neutral one was used for only 20 minutes. The respective consumptions of available chlorine under these conditions were approximately the same. The scoured and chemicked cheeses were treated together in the same peroxide bath for two hours at 65° C. using a peroxide concentration of 2.8 g/l calculated as sodium peroxide, and an alkalinity of 0.2N. Results of tests on these yarns were as follows:—

					TREATMENT	
					Scour, Alkaline Chemic, Peroxide	Scour, Neutral Chemic, Peroxide
Loss of weight	...	...	...	...	10.8%	13.4%
Breaking load.	Dry	...	...	...	8.5 lb.	7.8 lb.
	Wet	...	...	...	5.8 „	4.2 „
Original untreated yarn.	Dry	...	...	...	8.1 „	—
	Wet	...	...	...	7.1 „	—

The yarn given the alkaline chemic treatment was more lustrous and of slightly better colour than that treated with the neutral chemic whilst, as shown above, it had a rather lower weight loss and a higher strength in both the dry and wet states. Still better colour and improved lustre are obtained in the sequence scour, alkaline chemic, peroxide, if soda ash in the proportion 10 g. per litre is added to the hypochlorite liquor, other conditions remaining the same.

### Cheese Dyeing

Two cheeses of yarn that had been scoured, chemicked and bleached with peroxide as above were subsequently dyed in the usual manner in a cheese dyeing machine with 5 per cent. of Caledon Jade Green 2GS. No oxidising agent was used to develop the shade. The washed yarn was soured with 0.5 per cent. hydrochloric acid, washed, soaped at the boil, further washed and dried. The brightness of the final shade was a notable feature.

On cutting one of the cheeses in two, no variation of shade from inside to outside could be detected and the dyeing appeared to be level, but in order to enable a better examination to be made, the second cheese was rewound into cops and woven as weft into a cotton warp to give a weft-faced fabric. This cloth showed that very good levelness had been secured in the dyeing; no abrupt changes of shade occurred at cop ends, neither was there any sign of progressive change of shade from one end of the fabric to the other, that is, from the outside to the centre of the original cheese. The shade obtained was a close match to that of a similar 5 per cent. dyeing on linen cloth.

The results of these trials show that little difficulty is encountered in bleaching and dyeing jute cheeses in a package machine under the conditions stated.

### Bleaching of Mixed Yarns or Fabrics

Under the present world conditions greater attention is being paid to the mixing of a more expensive fibre or yarn with one that is cheaper or more readily obtainable, and an increased use of jute in this way may perhaps be possible. Combinations of jute with flax, cotton and wool are well known and have been used, but care should be taken in bleaching these mixtures because usually the treatment that is the most satisfactory for one fibre has a detrimental effect on the other. Some experimental work on jute mixture materials has already been done and is referred to below.

#### 1. Jute-Linen Yarns

The judicious admixture of linen and jute enables the more expensive linen fibre to be diluted whilst at the same time allowing the resemblance of the resulting yarns to all-linen yarns to be retained. In the bleaching of all-linen yarns much attention has recently been given to the use of neutral and acid hypochlorite liquors under controlled conditions of pH and to the subsequent use of peroxide solutions, and processes have been elaborated that constitute a marked advance over older methods, since they enable good whites to be obtained with satisfactory removal of sprit (the residual fragments of woody material from the flax straw) and above all with little degradation of the cellulose itself. It has already been shown<sup>2</sup>, however, that the use of acid hypochlorite solutions in bleaching jute should be avoided if strength is to be maintained. On the other hand, for linen, alkaline chemic liquors are much inferior to neutral or acid solutions both in attacking sprit and in contributing to a satisfactory final whitening of the yarns.

The best conditions for jute-linen yarns, therefore, should be obtained by using neutral chemicals in conjunction with a peroxide treatment, because not only are they capable of assisting in the production of very good white in linen, with removal of sprit, and with minimum degradation of the cellulose, but also they enable a good colour to be obtained on jute without serious loss of strength.

Since mixed jute-linen yarns in which the proportion of jute does not exceed 50 per cent. resemble, and are designed to replace all-linen yarns, a better colour than for jute alone is normally required and a 3/4 white on the linen scale must be aimed at, whilst sometimes even a 4/4 white may be necessary. On this account the conditions of bleaching covered by B.P.489,496, which provides for the use of the sequence "neutral chemic—peroxide bleach," are of special importance in dealing with these yarns.

A mixed tow yarn containing approximately 50 per cent. of both jute and linen was bleached (A) by the sequence oxidising scour; neutral chemic, peroxide bleach, and for comparison a similar treatment was given to a second batch (B) except that the neutral chemic was replaced by an alkaline liquor.

The conditions were:—(A) *Scour* in soda ash liquor 0.20N in alkali and containing 1 g/l of peroxide (expressed as sodium peroxide) for two hours at 65° C. Wash. *Chemic* for 20 minutes in a neutral hypochlorite liquor containing 4.2 g. of av.chlorine/litre, wash, sour, wash. *Bleach* in a liquor containing 2.8 g. of sodium peroxide, and 6.25 g. of sodium bicarbonate per litre (giving an alkalinity of 0.20N) for two hours at 65° C. The liquor to yarn ratios were in all cases approximately 10:1. (B) For the second batch of yarn (B) the neutral chemic was replaced by an alkaline hypochlorite solution of 5 g. of Av.Chlorine per litre which was used for 45 minutes.

The colour of yarn A was a good 3/4 white and markedly better than that of the corresponding sample for which alkaline instead of neutral chemic had been used, whilst the results of other tests were:—

Loss of weight ...	Yarn A ...	13.3%
Breaking load (Dry). Yarn A ...	4.0 lb.	
	Yarn B ...	3.7 "
Original unbleached yarn ...	3.8 "	

The weight loss is normal for a yarn of this type bleached to  $3/4$  white, whilst the strength values must also be considered good.

Further improvement in colour may be obtained if required by giving the  $3/4$  white yarn a "white dip" with a dilute hypochlorite liquor in the manner customary in linen bleaching.

The results indicate that for bleaching mixed jute-linen yarns the conditions covered by the patent quoted offer advantages over other methods.

### Jute-Cotton Materials

Mixtures of jute and cotton usually take the form of fabric in which a jute yarn as weft is woven into a cotton warp, whilst occasionally, for novel effects, jute and cotton yarns are folded to give composite fancy yarns. Unless the bleaching of the jute is taken to a stage when substantially only cellulose remains, that is, to a point when the jute complex has suffered considerably, it is difficult to obtain a pure white. Off-white effects that are satisfactory for most purposes, however, are obtained by using the sequence "Soda ash scour, chemic," or "Soda ash scour, chemic, peroxide." Scouring is best done at a temperature below the boil, whilst for the chemicking either a neutral or an alkaline hypochlorite liquor may be used, but the best colour on yarns consistent with retention of weight and strength has so far been obtained by using the conditions described above for the treatment of jute-linen yarns.

Some coarse materials may be scoured and peroxide bleached in the kier, but for other fabrics, where it is desirable to avoid creasing, the bleaching may be done on a dye jigger of the wooden beck type adapted for the use of peroxide liquors.

Where a specially good white is required, and loss of weight is not a highly important factor, mixed jute-cotton cloths of medium to heavy weights in which the cotton predominates may be given a pressure kier boil with 1 per cent. caustic soda solution, then washed and chemicked with an alkaline hypochlorite solution. In other words, the normal bleach customary for all-white piece goods may be used. With light or open-weave cloths the pressure boil is usually too severe. For very white fabrics it is best to employ as weft jute yarns that have already been bleached in the hank or in package form before being woven. If this is done the subsequent treatment of the cloth by pressure boiling and chemicking as for an all-cotton fabric enables good whites to be obtained that do not yellow on exposure to light. Such drastic treatment, however, should rarely be necessary, and is not advisable owing to its adverse effect on the strength of the jute.

### Jute-Rayon or Jute-Rayon-Cotton Materials

In novelty jute fabrics it is sometimes the practice to incorporate rayon or both cotton and rayon in order to obtain more attractive effects. Usually it is better to use cotton with the rayon because when rayon yarns are wetted they lose 40 to 50 per cent. of their dry strength, whilst bleached jute also becomes weaker on wetting, as already emphasised. On the other hand, cotton retains its strength on wetting and, therefore, to a great extent enables the weakening that would otherwise occur largely to be avoided.

When the rayon is of the regenerated cellulose type (i.e. viscose or cuprammonium) the sequence "soda ash scour—hypochlorite bleach" may be used with advantage but the scour should be mild and at a relatively low temperature in order to avoid undue loss of weight and possible weakening of the viscose. Also the hypochlorite treatment should be cold and the concentration as low as will enable the desired effects to be obtained on the jute without significant degradation of the viscose. Satisfactory conditions are, therefore:—Scouring at  $65^{\circ}$  to  $70^{\circ}$  C. for half to one hour in a solution containing  $7\frac{1}{2}$  per cent. of soda ash on the weight of fabric, followed by washing, and then bleaching for about one hour in an alkaline hypochlorite solution containing 3 g. of available chlorine per litre, and following with an antichlor in a dilute bisulphite liquor.

Normally, hypochlorite solutions of this strength would be considered to be too strong for viscose rayon materials, but when jute is present by far the

greater part of the oxidising agent is rapidly consumed by the non-cellulose constituents of this fibre so that the rayon is substantially protected.

The shade obtained by this treatment is usually cream to pale cream but much depends on the quality of the jute employed. With red Tossa varieties no very near approach to white is to be expected but with more readily bleachable types of Daisee and other good qualities much better results can be secured.

An alternative treatment giving rather whiter shades is to follow the above soda ash scour by a peroxide bleach for about one hour at 70° C. in a solution containing per litre 3 g. of sodium peroxide, 6.6 g. of sodium bicarbonate and 6 to 8 g. of sodium silicate, I.C.I. grade J.81 or C.100. If this method is adopted the residual bleach liquor should be used for scouring the next batch since such procedure is not only more economical but enables better shades to be produced than when the alkaline scouring liquor contains no peroxide.

When acetate rayon is present it is necessary to avoid hot alkaline scouring if all hydrolysis of the rayon is to be prevented. In this case, therefore, a wetting out treatment at 50 to 70° C. with a solution of an assistant such as Calsolene Oil HS should be given, and bleaching is best done with a hypochlorite solution of pH 9 to 11. Under these conditions no appreciable hydrolysis occurs for times of treatment with the bleach liquor up to two hours<sup>9</sup>. The processing is best done in open width on the jigger as there is then less likelihood of damage to the rayon than obtains when the fabric is treated in rope form.

#### **Jute-Wool Mixtures**

For jute-wool yarns or fabrics the use of hypochlorite is not permissible, and the bleaching is best done with peroxide following a mild scouring treatment. Reasonably good results on mixture cloths have been obtained by scouring for one to two hours at 45° C. in a liquor containing 0.2 per cent. of both soap and soda ash, or Lissapol and soda ash, and following this operation by a bleach at the same temperature in a 1 to 1½ volume peroxide solution made alkaline by the addition of sodium silicate. Treatment for three hours or more is required in order to give a satisfactory bleach, but usually it is difficult to obtain a first-class white because of residual yellowness in the jute that can be removed only under more drastic conditions. As wool materials are normally bleached to a creamy white rather than a pure white slight yellowness in the jute is relatively unimportant.

#### **Woollenised Jute**

When jute is to be mixed with wool it is sometimes first treated with concentrated caustic soda solution for the purpose of woollenising it. The treatment resembles in some degree the mercerisation of cotton except that no tension is applied, and it has the effect of shrinking the fibres and making them crinkled and springy, although in handle they become harsher and "scooped." The effect obtained depends to a very great extent on the concentration of caustic soda employed, and usually so rapid is the action that, as with cotton, only a few minutes are required provided that wetting-out by the caustic liquor is rapid. The greater the shrinkage the more crinkled are the fibres and presumably, therefore, the more satisfactory is the effect, but while yarn extensibility is considerably increased by the treatment, for example, from about 3 to 12 per cent, tensile strength is reduced. The loss of strength is due apparently to removal of hemicellulose and other alkali-soluble constituents of the jute since the lignin content remains substantially unchanged.

The effects of caustic soda on jute are illustrated by the results of the following experiments. Half-lea hanks of an unsoured yarn of initially the same size, were steeped for 10 minutes in caustic soda solutions of the strengths given, washed, soured, neutralised with sodium bicarbonate solution, washed and dried. Their lengths were measured under standard load, and tensile strengths and lignin determinations were made as recorded in Table IV.

From these values the shrinkage is seen to increase rapidly with increasing concentration of caustic soda up to 20 to 25 per cent. and thereafter only slowly,

The weight loss is normal for a yarn of this type bleached to  $3/4$  white, whilst the strength values must also be considered good.

Further improvement in colour may be obtained if required by giving the  $3/4$  white yarn a "white dip" with a dilute hypochlorite liquor in the manner customary in linen bleaching.

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The effects of caustic soda on jute are illustrated by the results of the following experiments. Half-lea hanks of an unscoured yarn of initially the same size, were steeped for 10 minutes in caustic soda solutions of the strengths given, washed, soured, neutralised with sodium bicarbonate solution, washed and dried. Their lengths were measured under standard load, and tensile strengths and lignin determinations were made as recorded in Table IV.

From these values the shrinkage is seen to increase rapidly with increasing concentration of caustic soda up to 20 to 25 per cent. and thereafter only slowly,

Table IV

% NaOH ...	0	5	7.5	10	12.5	15	17.5	20	22.5	25	30	40
% Shrinkage	—	3.0	4.2	6.5	11.8	20.1	23.2	26.2	27.5	28.1	29.5	31.2
500 g. load ...	—	85	80	67	—	58	—	45	—	52	36	44
% Strength ...	100	—	—	—	14.0	—	14.1	14.1	—	14.0	—	—
% Lignin content	13	—	—	—	—	—	—	—	—	—	—	—

so that from this point of view solutions of not less than 20 per cent. concentration should give the best effects. On the other hand, tensile strength diminishes progressively and approaches a minimum at about the same concentration of caustic soda. Since, however, material treated in this manner is used chiefly for mixing with wool, and the latter is capable of giving sufficient strength to the yarn, the loss of strength of the jute is of less importance.

It may be noted that the effect of concentration of caustic soda is here very similar indeed to that observed in the mercerisation of cotton where maximum effects are also obtained for approximately 20 per cent. solutions at the ordinary temperature.

Unbleached woollenised jute is dark brown in colour but it can be bleached readily with alkaline hypochlorite to a fairly light shade without further significant decrease of strength, whilst a lighter effect still is obtained if a subsequent peroxide treatment is given. The shades obtained with woollenised material are, however, yellower than those of plain jute for identical conditions of treatment, and from the experiments made in the course of this work it appears that woollenised jute is less readily bleached to light shades.

#### The Use of Bleached Jute in Mixture Fabrics

In the above work emphasis has been laid on the fact that an approach to white can be obtained only by removal of a considerable proportion of the incrustants of jute and in particular the lignin, and it has been shown that such removal has an adverse effect on the wet strength of the yarn. Furthermore, if material is required that will not yellow on exposure to light it is necessary to give treatments severe enough to eliminate all the lignin<sup>2</sup>.

If, for example, all-white mixed jute cotton or jute-linen cloths are required that will not yellow on exposure, the results obtained indicate that it is best to bleach the jute yarn first before weaving it into the cloth and subsequently to bleach the fabric itself by customary methods suitable for the second fibre. Although in this way the jute yarn loses strength and tends to approach the condition when there is little incrustant material remaining to bind together the short cellulose ultimates, if the weave is sufficiently close the strength of the cloth can be to a great extent retained because of the binding produced by the interweaving of the picks and ends.

It is obvious, however, that owing to the low wet-strength of well-bleached jute, any subsequent laundry treatments given to the composite fabrics must be conducted in such a way that severe mechanical action while the materials are wet is avoided. In other words much the same care must be taken as is observed in the washing of wool materials, where felting shrinkage can be avoided only by reducing mechanical rubbing to a minimum. If this precaution is observed the life of the fabric is not too seriously shortened because, on drying, the original strength is very largely restored.

As with rayon fabrics, dry cleaning solvents do not cause the pronounced fall of strength that accompanies immersion in water, and for this reason the dry cleaning of composite materials such as furnishing fabrics containing bleached jute may be considered to be satisfactory. For example, the mean breaking loads of a well-bleached jute yarn (*a*) in the dry state and (*b*) wet with trichloroethylene were found to be respectively 4.2 and 4.7 lb. In other words, yarn saturated with this solvent remains as strong as the dry yarn.



## Testing

The conditions of testing employed were those previously described<sup>6</sup>.

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- <sup>4</sup> Parsons, H. L. *J. Text. Inst.*, 1939, 30, P.311-326.
- <sup>5</sup> Ridge, Little and Wharton. "Jute Cellulose and the Relation of Jute Incrustants to Fibre and Yarn Strength" *J. Text. Inst.*, 1944, 35, T93-116.
- <sup>6</sup> Ridge and Little. *J. Text. Inst.*, 1942, 33, T.33-58.
- <sup>7</sup> Ridge and Little. *Paper Trade Review*, 1941, 116, Tech. Sup., 77, etc.
- <sup>8</sup> Laporte Ltd., and Weber. B.P.533,020.
- <sup>9</sup> Ridge and Bowden. *Shirley Inst. Mem.*, 1932, 11, 164, or *J. Text. Inst.*, 1932, 23, 319-366.

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# London Section

## PRACTICAL LAUNDERING TESTS FOR TEXTILE GOODS

*Paper delivered to the London Section, 21st March, 1944*

By WM. BROWN

Mr. Brown began by referring to the various "utility" specifications which had been evolved and the Government control of standards brought about by the war, but he suggested that the ultimate test of all textile goods was their reaction to laundering. In his view, this aspect was not fully appreciated by those whose responsibility it was to determine the quality standards to which textile fabrics should conform and he strongly urged that there should be active liaison between all sections of the textile industry and the laundry industry. It was his considered view that the need for liaison with the laundry industry was not sufficiently stressed as many fabrics found their way to the public which after one or two launderings were quite useless. Mr. Brown felt that this would not be rectified until all specifications besides referring to quality, durability, etc., contained a definite guarantee of "laundryability."

Dealing with the complaints received by the laundries, he stated that the most frequent one was that of shrinkage, the causes of which fell into two categories. One was peculiar to woollen garments and was due to the felting of the material, whilst the other was caused by the loss of the "stretch" (imparted in the course of the finishing process). In regard to the latter, he said that there was absolutely no known method of obviating the shrinkage as fabric which had been stretched to more than its manufactured size by the finisher reverted to its original size when immersed in water and, once lost, it was impossible to restore this "stretch." He could not understand, therefore, why fabrics were so stretched by the finishers, and the public forced to purchase garments sizes larger than necessary to "allow for shrinkage." In referring to shrinkage by "felting" Mr. Brown stated that this defect had been overcome by various anti-felting treatments. A process of controlled "chlorination" or equivalent process was applied to all Service underwear and Mr. Brown was convinced that all civilian garments should, by Government order, be similarly treated.

Referring to the misuse of yarns, Mr. Brown then passed round the meeting sample tablecloths in which rayon yarn had been incorporated in border stripes or in the weft; in each instance the rayon portion had shrunk in laundering, resulting in the puckering of the whole cloth where the border had

been of rayon, and the shrinkage of the weft in the second cloth, leaving a formerly square cloth, oblong. Although appreciating the many uses of rayon, he considered that it was quite unsuitable for household articles which must be constructed of a fibre which could withstand much laundering.

With regard to the restriction in supply of certain textile fabrics, Mr. Brown stated that this had led to the introduction of a considerable number of substitutes, many of which had given trouble in laundering. He instanced the substitution of jute for linen or cotton in kitchen towelling and stated that ordinary linen towelling could undergo a washing process designed to secure the cleansing necessary for rubbers, but that jute towels could not stand up to high temperature washing in special chemical solutions and had a life therefore of only two or three launderings. A sample cloth was shown to illustrate his remarks. Another instance where useless substitutes were employed was that illustrated by a mattress cover which was completely manufactured from paper which disintegrated on immersion in water.

Referring to other difficulties with which the laundry had to contend, mention was made of terry towelling, the loops of which "pulled" when laundered. There was a very simple remedy which was to wash the towels for the first time in nets, thus releasing the stretch of the ground weaving so that the loops were firmly anchored and this the laundry did whenever it consciously washed a new towel. Mr. Brown contended, however, that it was very often impossible to ascertain whether a towel was new or had been washed and he, therefore, recommended that the manufacturers should wash these towels before sale to the public, thus obviating this problem. He finally drew attention to the use of synthetic resins for stiffening collars which, when immersed in hot water, became plastic and formed lumps within the collar. Here also the lecturer was firmly convinced that by collaboration between the manufacturer of the material and the laundry, such glaring mistakes as the use of rayon in tablecloths, jute in rubbers, terry towels that "looped" and synthetic resins in collars, would be avoided.

#### DISCUSSION

Mr. Brassard stated that many of the faults in textile manufacture to which Mr. Brown had referred were the direct result of the horizontal method of production employed in England; as each process was undertaken by a different concern which had, in all probability, never seen the finished article. He referred to the Continental method of manufacture on vertical lines and stated that the consumer should be trained to appreciate the quality of the goods he bought. In regard to the "stretch" of fabric mentioned, Mr. Brassard stated that the finisher in most instances was ordered to return a 100 yard piece of material to the merchant at 110 yards. Referring to the other points raised by the speaker, Mr. Brassard stated that "chlorination" of woollen goods was not yet perfected sufficiently for use on the civilian market as the process rendered the material hard; in regard to the use of rayon for household purposes, he agreed with Mr. Brown that this was a practice to be avoided.

On the subject of shrinkage, Mr. Williams stated that the L.M.S. Railway found it too expensive to purchase pre-shrunk boiler suits, but purchased those two sizes too large instead. He was of the opinion that the manufacturer of the material did not appreciate its reaction to laundering, and it was from this aspect that a remedy should be sought and some form of quality control be maintained.

To this end Mr. Hill urged that the laundry industry's views should be taken into account to ensure that quality control was effective. He stated that throughout the whole process of manufacture the fact that the goods eventually have to be much laundered should always be borne in mind. Mr. Meredith agreed and was of the opinion that all research work was discontinued too soon, and thus the final test of a material, viz., its launderability, was not always submitted to close investigation.

Mr. Goodale proposed and Mr. Brassard seconded the vote of thanks to Mr. Brown, which was carried with acclamation.

## Lancashire Section

### TEXTILE INDUSTRIAL DEVELOPMENT

By E. J. POOLE

*Paper delivered to the Lancashire Section, 25th March, 1944*

Development work in an industry such as that represented by The Textile Institute must of necessity be complex, primarily because of the variety of materials at its disposal, more especially the varied nature of those of natural origin.

In consequence, equipment should be designed to manipulate the material in accordance with its peculiarities. Plant designed to process one type of material will not necessarily be suitable for another.

Practical experience has established this, but from observations and difficulties encountered throughout the industry there appears to have been comparatively little change, with few possible exceptions in connection with the design of textile machinery and the development of newer materials.

Taking a retrospective view of the industry and in particular the mechanical aspects, the control and manipulation of materials appear to have changed but slightly in principle from those of the earlier times. It must, however, be admitted that most ingenious mechanical means have been devised and are in fact in evidence throughout the industry. These would appear to have served their purpose of increasing production. In so far as newer methods, newer processes or unique and attractive fabrics are concerned there is great need for development.

The first world war was a prime cause of the industrial research and development of the synthetic fibre industry. In consequence of this development, cotton and wool productions suffered, not because of the introduction of these newer materials, but apparently because of the short-sighted view of the industry and its lack of some form of parallel development.

As far as the cotton and wool industries were concerned, the introduction of synthetic fibres, and no less other fibres, was regarded with indifference by some and with serious concern by others; hence these new developments were not considered in their true perspective nor exploited commercially to any appreciable extent except apparently by those responsible for their introduction.

In some respects, the cotton section of the trade may have had reasons for alarm by the introduction of other cellulosic fibres, but for doubtful reasons, similar alarm pervaded the wool section. Apparently not until interesting fabrics produced abroad were marketed was it realised that such synthetic fibres could be combined to some advantage with cotton and wool.

The textile industry of this country maintained a tradition common to it with regard to fashion and design, in apparently waiting, perhaps unconsciously, to be shown the possibilities of the use of synthetic fibres by other industrial centres of the world.

As was the case of this development at that time, we now appear to be in a similar position with respect to the development of textile machinery. Amazing strides in engineering and machinery design for the requirements of war have been made. Is there to be another waiting period for a lead from outside in possible industrial applications of war developments? The magnificent achievements for the purposes of war are surely very clear and will, without doubt influence future mechanical development and introduce the need for greater skill and specialisation in industry with accompanying methods of increased production requiring higher efficiency.

Radical changes in machinery design would appear inevitable in order to cope with the future demands upon industry. It is held that after the war all available machinery and labour in the textile industry will be required for a period of one to three years in order to meet the expected immediate demand.

Should this period extend to three years, which may be probable, the period beyond such a time must not be forgotten because of the immediate apparent prosperity and activity of the industry.

Whilst immediate demands are being met, international trade will be constantly under review and other hitherto undeveloped countries, apart from their recovery from the effects of war, will be preparing to enter into the markets of the world.

If it be assumed, and there appears good foundation for it, that these prospective entrants into the world's markets will produce mainly the simpler fabrics, then our attention will need to be directed towards revolutionary developments in machinery, processing and combining other natural and synthetic fibres with our basic raw materials.

The past has shown what could be done with two materials on which the industry has concentrated, namely, cotton and wool. From these has developed a very large re-manufacturing industry embodying practically all other fibres used in textile manufacturing.

The ingenuity displayed in this large industry in cloth structure, designing and finishing has been great. Its products warrant admiration.

Much development is called for in the production of new fabrics by improved processing, thus enabling new types to be evolved which would possess unique features, not only in appearance, but in wear and handle. They would also be enhanced by differential dyeing and finishing properties and other possible chemical treatments of the materials used.

No apology is offered for suggesting that the different research associations could give practical assistance in revealing physical and chemical features peculiar to different fibres and their behaviour in use from a decorative angle.

By a judicious selection and combination of fibre materials whose physical characteristics are known, together with physical and chemical finishing treatments, it is obvious that new yarns and fabrics with distinctive features might be produced.

Such fabrics however will not be produced without expert personnel and the training of such personnel should now be the immediate consideration of the industry.

Perhaps the majority will have to be instructed from the beginning, but there will be others, at present in the forces, some of whom will be partially trained and should be given every facility to complete their training and there will be those who have been fully trained with some industrial experience, and should be encouraged by the industry to return and offered every possible means to receive a revision course.

The industry may possibly arrange for this through their research association by a scheme whereby those requiring a revision course might be interchanged with trainees in the association who need industrial experience.

As regards new entrants into industry, interest must first be stimulated whilst at school, possibly by a material extension of lectures illustrated by slides or films, given by qualified members of The Textile Institute to scholars of the higher forms in their last one or two years. This may be essential in view of the raising of the school leaving age.

Those subsequently entering industry should then receive a practical training combined with scientific and technical studies, and this scheme would appear highly desirable in order that they may gradually appreciate the absolute necessity for both practical and theoretical training.

At the stage of proficiency, it should be generally realised that it is in the interests of the industry to retain such personnel, otherwise the possibility may arise of key personnel being attracted elsewhere, most probably abroad to the serious detriment of the industry.

Mr. Cleveland Belle, Director of the Cotton Board's Colour, Design and Style Centre, speaking at Manchester Art Gallery some time ago made a plea for reconciliation of the traditional genius of England in the designing and

making of beautiful textiles with the mechanical genius which gave this country the leadership in the mass production of cloth in the 19th century. This will depend upon the training our textile designers and technicians receive and would appear to call for a closer co-operation between the appropriate bodies so that it may be made possible to recognise the textile designers and technicians under the heading of industrial designers.

What has been required is a faculty in design to raise the status of the industrial designer and this has now been established by the Royal Society of Arts under the qualification of the R.D.I. It should be more widely acknowledged and appreciated throughout the industry.

Encouragement should also be given to personnel of an inventive turn of mind with a view to creating in the much anticipated new era of textile machinery, such devices whereby firstly the "blind alley" occupations may be eliminated, except for preparatory training, and secondly, to facilitate the performance of many manual operations. Ample evidence may, it is hoped, be brought forward by the textile machine makers to satisfy the industry in this direction of new equipment and machinery. Yet, whatever the developments, there will still no doubt be those operations which will require minders, and it is important that some means be found to relieve the monotony of the work of these operatives. Not much appears to have been done in the direction of interesting such operatives in the application or uses of the materials they may be working and the consequence of faulty attention.

A scheme might be devised possibly in the form of exhibits of articles into which the materials are made and self explanatory illustrations of processes. The consequences of imperfections in the materials and of careless handling should also be fully explained. There is no reason why operatives should not share to some extent in the trials of articles of wear made from the materials they handle so frequently, such an arrangement would stimulate considerable interest and encourage good work, and would be to the advantage of the industry, especially if the operative could be encouraged to give intelligent and informative reports on such trials.

From the foregoing remarks and suggestions it may be inferred that the industry has done little to keep up to date in equipment and ideas and to stimulate greater interest in the personnel of the industry in their respective capacities.

It may, to the layman, appear that the industry has conducted its affairs in a haphazard manner, indifferent to certain aspects of its work and continuing with obsolete machinery as long as possible and has copied and followed others in a *laissez faire* manner.

Let it be the sincere intention and personal ambition of each and everyone to see that scientific developments and discoveries are directed aright to the benefit of all humanity and not to destruction. The textile industry has achieved much and there remains much to be done. It has been stated by an eminent statistician that the textile industry is one of the most highly organised, and it must be admitted that well qualified business men and industrialists in the industry have made great efforts to maintain modern plant, factory conditions and other amenities. All such efforts, however, will be of no avail without a revival of the personnel of the industry, and of the incentive and ambition on the part of each individual to restore the industry of the country. Nothing will be achieved unless there be a greater freedom of co-operation between the different sections of the industry and some marked degree of co-ordination to avoid unnecessary duplication and irrational competition. The different standards of living of possible competitors still remains a basic problem but, with unity of purpose and concerted action throughout the industry in which the Textile Institute should serve in no small capacity, there should be a reasonable chance for the textile industry to retain its prestige and help to revive prosperity in the United Kingdom and throughout the world.

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## General Items

### Textile Institute Scholarship

At a time when so much consideration is being given to the reconstruction of the textile industry, and particularly to the recruitment of personnel, it is interesting to know that the Institute has just awarded its fourth scholarship. The new scholarship holder is Ronald Sanderson, of 162, Smith Street, Nelson. He was formerly employed with a firm of textile manufacturers in Nelson where he also attended the Municipal Technical College for an evening course in Cotton Weaving. At the present time he is taking a degree course in the Department of Textile Industries at Manchester College of Technology.

The Institute Scholarship, which is one of the most valuable awards available, has a maximum value of £200 a year for the first two years, and of £350 in the final year. If conditions permit it is highly probable that Mr. Sanderson will utilise the scholarship in order to continue his training abroad after he has completed the degree course.

The award is made possible under the terms of a grant from the trustees of the Cotton Trade War Memorial Fund in 1928. The scholarship is available for young craftsmen engaged in the cotton spinning or cotton weaving industry of this country, and enables them to follow an approved course of study, and have an extended training of a special character, or gain industrial experience at home or abroad.

The Scholarships Committee are of the opinion that the type of training which this award permits is eminently suitable for producing the type of man who will be required to play a leading part in the future of industry.

### Award of Research Studentship

In May, 1943, the Institute published in the *Journal* a scheme for the award of Research Studentships. The first award has now been made to Mr. R. L. Kitchen, A.T.I., of Huddersfield. In accordance with the scheme, facilities for research are being provided by the University of Leeds, and Mr. Kitchen is undertaking investigations on the subject of "The Action of Hypochlorites and Related Compounds on Proteins, with Special Reference to their Use in Rendering Wool Unshrinkable."

The proposals for the provision of facilities in connection with the research studentships came, in the first instance, from the University of Leeds. The Institute would like to emphasise, however, that any proposals from other Educational Bodies on similar lines would receive equal and sympathetic consideration.

### Honorary Life Membership

At the November meeting of the Council, Mr. W. W. L. Lishman, of Todmorden, was unanimously elected as an Honorary Life Member of the Institute in recognition of his valuable services. Mr. Lishman acted as Honorary Treasurer of the Institute from 1930-42, and at the present time he is a Vice-President.

### Institute Diplomas

Elections to Fellowship and Associateship have been completed as follows since the appearance of the previous list (October issue of the *Journal*):—

#### FELLOWSHIP

THOMAS HUGHES ROBINSON, F.R.S.A., A.T.I.  
Managing Director, Myers & Robinson Ltd., Bingley.

#### ASSOCIATESHIP

RALPH WILKS

At present serving in H.M. Forces, formerly with C. F. Taylor & Co. Ltd., Shipley.

## Institute Membership

The following applicants were elected to membership at a recent meeting of Council:—

### *Life Membership*

Wilfred H. Barker, High View, Wigan Lane, Chorley, Lancs. (Practical Research and Service Overlooker, Automatic Weaving Machinery, Messrs. Willan & Mills, Rosehill Iron Works, Blackburn).

Emyr Williams, Mill Bank, Trefriw, Caernarvonshire, N. Wales (Woollen Manufacturer, Vale of Conway Woollen Mills, Trefriw, N. Wales).

### *Ordinary*

Reginald James Bray, M.Sc., A.R.C.S., D.I.C., 43, Whinfield, Adel, Leeds 6 (Textile Research Advisor, John Foster & Son Ltd., Queensbury, Nr. Bradford).

Charles Joseph Breakell, 27, Woodside Avenue, Ribbleson, Preston (Salesman and Cardroom Manager, Richard Haworth & Co. Ltd., Ordsall Lane, Salford 5).

Thomas Rennie Dodgson, Brookdale, Hamilton Road, Whitefield (Managing Director, John C. Hamer Ltd., Hope Hill, Radcliffe).

Arthur Fort, 131, Cheadle Old Road, Edgeley, Stockport (Manager, Cheadle Heath Condensor Mill Ltd., Gorsey Bank, Stockport).

George Garside, 9, Turnpike Street, Elland (Worsted Spinning and Twisting Overlooker, Robinson & Barraclough Ltd., Hollyns Mill, Greetland, Nr. Halifax).

K. Hisamouddin, West View, Upper Park Road, Manchester, 14 (Student, Manchester Municipal College of Technology).

John F. McGregor, 23, Blairgowrie Road, Glasgow, S.W.2 (Chemist, Research Laboratory Staff, J. & P. Coats Ltd., Paisley).

Robert William Myers, 39, Fieldway, Clayton, Bradford (Director, T. Butterfield & Co. Ltd., Grattan Mills, 122, Sunbridge Road, Bradford).

George Richard Payne, 13, Fenton Street, Burley-in-Wharfedale, Nr. Leeds (Textile Designer, S. Bottomley & Bros. Ltd., Buttershaw Mills, Bradford).

Arnold Shepherdson, B.Sc., 19, Dawlish Road, Chorlton-cum-Hardy, Manchester (Research Consultant, I.C.I. Dyestuffs Division, Blackley, Manchester, 9).

Frank Edward Stringer, "Newlands," Cursis Stream, Palmerstown, Co. Dublin (Woollen Factory Manager, c/o Hill & Sons Ltd., Lucan, Co. Dublin).

Charles Edwin Whitfield, 7, Daleside Road, Riddlesden, Keighley (Head Designer, Driver, Hartley & Co. Ltd., Dryart Mills, Keighley).

### *Junior*

Peter Burrows, "Howley Dene," Scotchman Lane, Morley, Nr. Leeds (Textile Apprentice and Student).

Albert Hargreaves, 15, Carloon Drive, Wythenshawe, Manchester (Laboratory Assistant, Chamber of Commerce Testing House, 113, Barlow Moor Road, Didsbury, Manchester).

Walter Nutter, 19, Bentley Street, Nelson (H.M. Forces).

Halil Sancak, 1, Otterburn Gardens, Lawnswood, Leeds, 6 (Student, Leeds University).

Ralph Turner, 79, Walden Drive, Haworth Road, Bradford (Apprentice Dyer—Textile Chemist, Chas. Fox & Co. (Dyers) Ltd., Jesse St. Dyeworks, Manchester Road, Bradford).

### Employment Register

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:—

- No. 138.—Desires position as Hosiery Works Manager or Assistant Manager. Age 39 years. Technical knowledge of Hosiery Manufacture and Yarn and Fabric testing. Thirty years practical experience of Knitting, Mechanics, Foreman and Works Manager. For last 17 years has been Works Manager on plant of fine-gauge fully-fashioned hose and seamless half-hose. Would consider starting up a new plant. Willing to go abroad.
- No. 139—Young man, 31 years of age desires administrative post dealing with the chemical processing of textiles. A.R.I.C., A.T.I., A.M.I.I.A., A.M.C.T. Higher National Certificate in Chemistry. Many years experience as Chemist and Examiner of textiles.

## NOTICES: INSTITUTE MEETINGS

### LANCASHIRE SECTION

Saturday, 2nd December, 1944—*Manchester*. 2.45 p.m. Lecture: "Nylon Yarns and Some Aspects of Processing and Finishing," by G. Loasby, B.Sc., F.R.I.C., F.T.I. (British Nylon Spinners Ltd.) at the Central Library.

Friday, 8th December, 1944—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's premises. "Production of New Designs for Export," by S. Swinburne (Geo. Tingey & Co. Ltd.).

### MIDLANDS SECTION

Saturday, 16th December, 1944—*Leicester*. 3.0 p.m. Lecture: "Factory Organisation and Costing," by T. Alan Pratt, A.S.A.A., A.T.I.I. (Secretary, British Hosiery Manufacturers' Association) at the Colleges of Art and Technology.

### YORKSHIRE SECTION

Monday, 4th December, 1944—*Bradford*. 6.30 p.m. Lecture: "Scaffolding Threads in Yarn and Cloth Structure," by A. Johnson, M.Sc., F.T.I., at the Midland Hotel.

Members of the Institute are also invited to attend the following meetings:

Friday, 15th December, 1944—*Manchester*. 6.0 p.m. Lecture: "High Tenacity Rayons," by L. Rose (Courtaulds Ltd.). By invitation from the Society of Dyers and Colourists, Manchester Section; at the Grand Hotel, Aytoun Street.

Tuesday, 19th December, 1944—*Manchester*. 6.30 p.m. Dalton Lecture: "Chemistry and Clothing," by Dr. Clibbens (Shirley Institute). By invitation from the Royal Institute of Chemistry, Manchester and District Section; at the Central Library.



# THE JOURNAL OF THE TEXTILE INSTITUTE

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## PROCEEDINGS

### Lancashire Section

#### COLOUR FROM THE ARTIST'S POINT OF VIEW

By L. F. N. REID

*Paper delivered to the Lancashire Section, 10th March, 1944.*

In thinking about what I should say to you on the subject of colour I became more than ever aware that it is a subject which can be approached from many different angles, and which may suggest different things to each of us according to what use we make of it. Some of us may think of colour in terms of dye, others in terms of paint. Some of us use it in the form of yarn, and yet to others, the more scientifically minded of us, colour is something to be measured in terms of wave-lengths, or to indicate the chemical composition of the sun. I came, therefore, to the conclusion that I had better talk about it from my own point of view, which is the artistic point of view, and I propose, if I may, to talk rather generally about colour as we normally experience it, and as the artist thinks about it.

Colour is a precious possession of all who can see. It is an accompaniment, so to speak, to the routine of our existence, an accompaniment which is constantly varying, which is different each day, and which changes from minute to minute. The sky is never quite the same colour from moment to moment. Grass, when we come to regard it more closely, is never quite the common shade of green we imagined it to be. The streets through which we walk have light and shadow about them, and all the colour changes associated therewith. Colour is there, to be enjoyed, if we but take the trouble to look for it. It is a thing of pleasure, often of joy, sometimes of sadness too. It can be made to express our moods, or it can, of itself, influence or change our moods. It is a gracious thing which can endow the drabness of our industrial areas with a celestial beauty. I have seen here in Manchester views which, in colour at least, could not be surpassed for beauty anywhere in the world.

It may be interesting to consider for a moment, what colour really is. We are inclined, perhaps, to think of colour in terms of pigment, and to accept our paints, and our dyes as being in themselves colours. Colour, to exist at all, seems to depend upon two things: upon light, and upon our ability to see light. Without light, daylight or artificial light, our pigments would have no colour. As is well known most ordinary sources of light consist of a mixture of a number of different rays of colour, which together give the effect of daylight or artificial light. We are not conscious of the mixture of colours in light unless the mixture is disrupted in some way. Pigments supply a means of disturbing the mixture in such a way that we are enabled to see one or more of the constituent colours. For example: a red pigment absorbs most of the light which falls upon it, the green, the blue, the yellow, and so on, but reflects back the red. Were there no red in the light mixture there would be no colour for the red pigment to reflect, in which case it would not appear to be red.

The reflection from the pigment is detected by our eyes and is recorded by the brain as a sensation of colour. The sensation recorded depends upon how

perfectly our eyes respond to what is before them. It is not uncommon to find that some people are blind to certain colours. To a person blind to red our red pigment would still not be red, even though it were brilliantly illuminated with light of a suitable hue. Ultimately colour seems only to exist in the mind of the person looking at it.

It may be asked "Can colour vision be improved by training?" Within the limits of a person's ability to see colour his perception of it can be developed. A colour-blind person can not be made to see colours to which he is blind. But a person with normal vision can develop a greater sensitivity to colour. This greater sensitivity is a keener perception of what is looked at rather than an improvement of the eye itself. Most people are rather lazy in looking at things. They see the obvious but tend to miss detail. For example: if a number of people who had passed by a house in a street were to be asked to describe it, few would have observed much more than that it was a large house or a small house. Most would be able to say if it had one storey or two, but few would be certain if it had three storeys. Very few would be able to describe it in anything like detail, unless they had cultivated their powers of observation, or were especially interested in the house.

So it is with the seeing of colour. Most people only see the obvious. They will see a blue, or a yellow, or a brown. Most will be able to say if it is a dark or a light colour—the equivalent of the large or small house—but very few would be able to say afterwards if the blue were a green-blue or a violet blue, or if it were an orange-yellow or a lemon-yellow. A trained observer would, of course, be quite definite about the colour he had seen, and would probably be able to reproduce it for you, given the necessary pigments. Most colours that we see are a mixture of two or more of the spectrum colours.

It is very rarely that we see a pure colour, a pure yellow, for instance, a yellow which is neither slightly orange nor slightly green. Colours as we experience them are usually chords of several different colours. A person with a well developed colour vision will see, *actually* see, the component colours of the chord. Most people can learn to see chords of colour in this way. Some more readily than others. Observation is largely a matter of reasoning about what one sees. A combination, as it were, of seeing and thinking. People usually observe most carefully the things they are most interested in. They observe them and remember them because they think about them. So with colour. Those who are interested in colour observe it carefully, and think about it, and discover its endless variations. They store their observations in their minds and, if they use colour as artists and designers do, they draw upon their store of colour experiences to produce colour schemes. In the production of colour schemes we find that some are better colourists than others. Some produce colour schemes more readily than others, or they produce schemes of particular excellence and unusual in their combination. Such people are said to have a good "Colour Sense."

Now, colour sense is not quite the same thing as colour perception. It is the ability to select certain colours and to combine them together in suitable quantities. Colour sense is an innate quality of the individual, a peculiarity of the individual's mental make-up. It can be exercised and developed if it is present, but no amount of training will develop a true colour sense if the individual does not possess one to start with. It is a sort of "poetic touch" in the use of colour. Just as the average individual can acquire an amount of facility in writing rhymes, sometimes even with a trace of poetry in them, so the average individual can learn about harmonies and contrasts, about colour combinations which are generally considered pleasing, and about those which it is best to avoid. But it takes a highly developed "colour sense" to evolve unusual and possibly new colour schemes which will have about them a sense of poetry to lift them from the commonplace to the ethereal, and which will, at the same time, be admirably suitable for their purpose and which will give exceptional pleasure to their beholders. Such colourists are few, and are not

easily found, but when they are discovered they must be of inestimable value in industries where colour is of extreme importance.

Colour and design are very closely linked. A good colour scheme has much about it in the way of balance, rhythm, and proportion which is common to the arrangement of shapes in a design. It usually happens that a gifted colourist is endowed with good taste in many directions. He is likely to be a good designer (in the textile sense), a good illustrator, a good interior designer, a good stylist. I need hardly say that such a person would be extremely useful in such an industry as the textile industry which has to cater for a diversity of requirements. A good designer and a good colourist is apt sometimes to be a fickle creature, who, as some of you will very well know, is not always so concerned with such mundane things as the material side of production as perhaps you would like him to be. But for all that he is a treasure to be highly valued. Frequently he lives in a world which is ahead of the present. Art which is virile is always rather in advance of its time. We might think of the artist as one who brings us back samples from the future. We do not always appreciate the samples he brings back, but we usually learn to understand them in time.

I would like to make this plea for the artist, for the colourist, for the designer (he is all the same person in slightly different guises) that he be given more importance in industry than he has generally had, and that he be given greater freedom in his working conditions. Don't cage him up in a dismal atmosphere and expect him to work to a routine or he will become dull. When this war is over he will be able to help tremendously in reviving our industries. Most countries, after the war, will be restarting production with a "clean slate," so to speak. Many traditions, both good and bad will have been expunged. It will be a time when all will start level—a time when it will be easy to break new ground, to embark upon experiments which previously might have been over-ruled by tradition—a time when each country will be striving to capture world markets.

As in this present war of destruction when there have been many new devices, many new tactics, so in the constructive struggle which will follow there will be new and surprising developments which will tax all the enterprise of the generals in industry. It will be a time when our "samples from the future" will be very useful.

Our designers and our colourists in Britain will not let industry down. I am convinced that we have as good here as anywhere in the world. Let the utmost use of them be made.

## Review

**Regression Analysis of Production Costs and Factory Operations.** Philip Lyle.

Oliver & Boyd. 208 pp. 15/-.

Costing starts from records of productions, speeds and wages, and yields an indication of the average cost. Each figure in the calculation is known to vary: belts slip, tensions change, the weather dries or chills; but in a first estimate of cost these things are disregarded. An estimate so made is useful so long as its limitations are understood, and it is taken as a starting point for more detailed analysis and estimation.

In practice the ease with which the estimate can be shown, in particular circumstances, to be wrong, too often discourages its use and on the other hand, the apparent accuracy of the figure, given to so many places of decimals, too often encourages extrapolation far beyond its true capacity. Mr. Lyle takes up the subject from this point. His problem is how to use the varying records of weekly consumption and production to estimate the "factory fixed cost," and the "marginal cost" of the product, and to provide a measure of accuracy of the estimates. The usual methods of accountancy are useless for this purpose, but some of the methods of statistical analysis developed in connection with agricultural and biological research are directly applicable.

The author gives a practical exposition of these methods with fully worked out examples; calculation of regression lines, correlation coefficients, and

fiducial limit bands. The reader is referred to the textbooks for proofs and principles, but the book is quite complete in its way.

Starting as a booklet circulated privately in the sugar refining industry, it has been expanded, checked and modified into something well worth reading. Skipping the mathematical parts there is the story of a practical man's attempts to be systematic and logical in his approach to costing, and, returning to the figures and formulæ, the reader is lead step by step through the necessary calculations to results of practical interest. Finally, two long appendices collect miscellaneous practical notes on short cuts and checks in computation, fitting curves, use of nomograms, and the meaning of regression and correlation.

The results of some of these calculations may seem small for the labour involved, and the fiducial limits may show a surprisingly wide range of likely values; particularly at the extremes where policy makers would find some solid figures most welcome. The fact remains, however, that when the additions and subtractions of accountancy have yielded all they can, there is still much in doubt, and still a great deal of information hidden among the variability of the data. Mr. Lyle describes how to extract this information. If it had been easy, it would have been done before.

A. W. BAYES.

### Additions to the Library

The following publications have been received in the Library:—

*Science and Salvage*—Dr. Claus Ungewitter. Crosby, Lockwood & Son Ltd., London. Price 12/6.

*Research and Progress in the Textile Industry*—Alex. Engblom. Reprint from *The Svedberg, Uppsala*, 30/8/1944.

*An Investigation of the Influence of Ring Size, Bobbin Diameter and Spindle Speed on the Spinning Process and their Effect on the Overall Cost of Spinning*. F. P. Sheldon & Son, Providence, Rhode Island, U.S.A.

### Refresher Course in Textile Technology

The Department of Textile Industries, Leeds University, proposes to give a refresher course in Textile Technology, and for the information of members and others the detailed Syllabuses are reproduced.

The course is planned to occupy three months and is intended for service men who have had previous training in textile technology. The lectures occupy ten hours per week, leaving twenty hours per week for practical work, which may be spent in those sections of the Department in which the student is most interested. At the end of the course service men should be fully acquainted with the developments which have taken place during war years, and they should have had ample opportunity of renewing their acquaintance with the machinery and processes of the industry.

#### Textile Chemistry

*Professor J. B. Speakman, D.Sc., F.I.C., F.T.I.*

The course of ten lectures will be devoted to the chemistry of the raw materials of the textile industry, the applications of this knowledge to existing processes, and its use in the development of new materials and processes. An outline of the course is given below:—

**Proteins:** The chemistry of the proteins, with particular reference to the properties of wool and silk, and the synthesis of fibres from the proteins of milk (casein fibre), peanuts (Ardil), and soya beans. A precise interpretation of existing processes of the wool-textile industry will be attempted, and the development of the newer ways of making wool unshrinkable, of producing wool crêpes by chemical means, and of causing rapid shrinkage, described.

**Cellulose:** The chemistry of cellulose and its derivatives, reference to processes such as mercerising, production of synthetic fibres, including the newer types of specially strong rayon.

**Alginic Acid:** The production, properties and uses of seaweed rayons.

**Plastics:** The chemistry of polymerisation and the formation of synthetic resins. Special attention will be given to the manufacture of synthetic fibres, e.g. nylon and vinyon, and the uses of synthetic resins in the finishing of textile materials, e.g. for producing an unshrinkable finish on wool.

**Textile Physics**

(The Molecular Structure and Properties of Fibres).

*W. T. Astbury, M.A., Sc.D., F.Inst.P., F.R.S.*

There are two main trends in present day research into the molecular structure and properties of fibres; one is a process of unification, that recognises that all fibres, whether industrially or biologically important, whether natural, regenerated, or synthetic, are members of one great family that must be studied as a whole; and the other is the more detailed working-out that follows from new or improved techniques, the application of newly discovered scientific principles, etc. Both these aspects of fibre studies will be developed in the course, and particularly will it be shown how plastics come into the textile story and promise to become a major part of it, and how the theory of artificial protein fibres is also opening up new chapters that must be taken seriously in post-war affairs.

The lectures on detailed progress will deal with advances in the polysaccharide fibres as illustrated, for example, by the relation between cellulose and the alginate fibres from sea-weed, but mostly they will be concerned with the progressive elucidation of the molecular structure of the keratin fibres.

On the physical side the lectures will rest chiefly on the results of X-ray analysis, but if time permits, an introduction will be given to the latest weapon in structure research, the electron microscope.

**Materials Study***F. Pickles, M.Sc., F.T.I.*

(1) British sheep and wool. Mountain, lustre, demi-lustre and down types. Methods of marketing and uses.

(2) Colonial sheep and wool. Origin of Merino sheep and its development in the Dominions. The creation of crossbreds and similar types. Colonial and London wool sales. Wool control.

(3) Wool sorting. Reasons for wool sorting. The meaning of quality numbers and comparison of terms. Spinning quality.

(4) Skin wools. Reasons for development of skin wool industry. De-woolling methods. Uses and value of skin wool in industry.

(5) Synthetic fibres. Methods of production. Their uses in (a) filament form, (b) staple fibre form, and (c) blended with wool.

**Woollen and Worsted Yarn Manufacture***P. P. Townend, Ph.D.*

(1) Résumé of the processes of woollen yarn production.

(2) Fundamental principles.

(3) Problems arising during the manufacture of woollen yarns.

(4) Applications of recent research work, including the use of the newer synthetic fibres.

(5) Developments in woollen yarn machinery.

(6) The same topic (1-5) for worsted yarn.

(6) The same topics (1-5) for worsted yarn.

**Weaving***A. Johnson, M.Sc., F.T.I.*

The preparatory processes of weaving, including winding, warping and healding.

A study of the major mechanical details, the figuring capacities and production of the following looms:—Tappet, dobby, jacquard.

An outline of the utility of the various types of automatic weft-replenishing looms, including their most important accessories.

**Cloth Analysis, Cloth Structure and Complex Textiles***G. Priestley, M.A.*

*Cloth Analysis.* (1) General features involved in cloth analysis. (2) Analysis of backed and kindred fabrics. (3) Analysis of double and treble cloths.

*Cloth Structure.* (4) Methods of design production for single make fabrics. (5) Structure of backed and kindred fabrics. (6) Structures of compound fabrics.

- (7) General principles of colour applied to fabrics.  
*Complex Textiles.* (8) Economic production of compound fabrics. (9) Gauge fabrics and their production on dobby and jacquard looms. (10) Pile fabrics.

### Finishing of Textile Fabrics

*C. S. Whewell, Ph.D., F.T.I.*

The following topics will be considered in a course of ten lectures:—

- (1) The objects of cloth finishing and a general outline of the processes involved. (1 lecture.)
- (2) Modern cloth finishing machinery. (2 lectures.)
- (3) Recent advances in clothing scouring, milling and raising. (2 lectures.)
- (4) Methods of rendering wool fabrics unshrinkable. (1 lecture.)
- (5) Waterproofing and mothproofing. (1 lecture.)
- (6) An introduction to methods of finishing cotton and rayon fabrics. (1 lecture.)
- (7) Bleaching of textile fabrics. (1 lecture.)
- (8) Sanforising and crease-resisting. (1 lecture.)

### Textile Testing

*F. Pickles, M.Sc., F.T.I.*

- (1) The counts of yarn. Methods of testing yarn for count. Use of wrap reel. Gauge points. Special balances.
- (2) The strength and elongation of yarn. Single thread testing; hank testing. Effect of varying speeds of testing machines. Effects of humidity. Tests on different lengths of thread.
- (3) The effects of twist on yarn. Definition of twist. Various rules for fixing twist. Effects of twist on strength and elongation of yarn and cloth.
- (4) Strength and elongation of cloth. Specifications. Various tests and types of machines. Necessity for controlling temperature and humidity. Preparation of test specimens. Effects of weaves and wear on tensile strength.
- (5) Defects in yarns and fabrics. Defects arising in processing, spinning, warping, winding, weaving, finishing. Periodic effects.

### Statistics (Ten Lectures)

*H. J. Woods, M.A., F.Inst. Phys.*

The course will aim chiefly at indicating the scope of statistical methods used in testing and control of processes. Only elementary mathematics will be used.

### The Technical Aspects of Mill Management

*N. H. Chamberlain, Ph.D.*

- (1) Power Supplies in Textile Mills.
- (2) Power Distribution in Textile Mills. (a) Mechanical Distribution.  
(b) Electrical Distribution.
- (3) Power Costs in Textile Mills.
- (4) Prime Movers in the Textile Industry.
- (5) Prime Movers in the Textile Industry (*continued*).
- (6) The Corrosion Problem.
- (7) Lighting, Heating and Ventilation in Textile Mills.
- (8) Modern Tendencies in the Application of Electric Power in Industry.
- (9) Modern Developments in Steam-Raising Plant and the Economical Use of Steam.
- (10) Planning the Mill of the Future.

Visits to the mills of the West Riding of Yorkshire will be arranged during the course.

## Institute Diplomas

Elections to Fellowship and Associateship have been completed as follows since the appearance of the previous list (November issue of the *Journal*):—

### FELLOWSHIP

GEORGE HENRY HOTTE, M.Sc., A.T.I.,  
Director of Research and Development, Laboratories, Fine Goods Division of  
Wellington Sears Co., Boston.

WILLIAM OGILVY,  
Manager, Baxter Bros. & Co. Ltd., Dundee.

### ASSOCIATESHIP

MITCHELL ANDREW SIEMINSKI, B.Sc.,  
Assistant Director, Laboratory Division, Warwick Mills, Boston.

## Institute Membership

The following applicants were elected to membership at a recent meeting of the Council:—

### Ordinary.

F. W. Andrews, 1, Kingston Drive, Sale (Area Sales Manager—Dyestuffs, Imperial Chemical Industries Ltd., Ship Canal House, King Street, Manchester).

Frank Barrass, 28, Sunfield, Stanningley, Nr. Leeds (Clerical Assistant to Chief Inspector, George Cohen, Sons & Co. Ltd., P.O. Box No. 1, Stanningley, Leeds).

William Andrew Bellerby, 3, Oak Avenue, Manningham, Bradford, Yorks. (Analysis and Testing of Textile Materials, Lister & Co. Ltd., Manningham Mills, Bradford).

George Edward Birkenshaw, "Lynton," 10, Welburn Avenue, West Park, Leeds, 6 (Managing Director, David Dixon & Son Ltd., Cardigan Mills, Kirkstall Road, Leeds).

Alfred Brasch, 9, Vowe Street, Harrismith, O.F.S., S. Africa (Costing, Standard Woollen Mills, P.O. Box 121, Harrismith, O.F.S., S. Africa).

Arnold Breare, B.Sc., M.Sc., A.R.I.C., Redlestone, Airville Road, Burley-in-Wharfedale (Assistant Works Manager, Jas. Smith & Sons (Cleaners) Ltd., The Dyeworks, Dewsbury).

Arthur Charlesworth, 85, Benamley Road, Almondbury, Huddersfield (Dyer and Works Chemist).

Adam S. Currie, 124, Dundonald Road, Kilmarnock (Technical Expert, Bleachers' Association Ltd., Blackfriars House, Manchester).

Arthur Dewhurst, A.C.I.S., Messrs. Richard Haworth & Co. Ltd., 35, Dale Street, Manchester (Director).

Stanley Fallows, 151, Moston Lane East, New Moston, Manchester, 10 (Draughtsman, Richard Haworth & Co. Ltd., Tatton Mills, Ordsall Lane, Salford, 5).

Harold Foulds, 19, Woone Lane, Clitheroe (Inspector of Textiles, Ministry of Supply, Hardy's Buildings, Cateaton Street, Manchester).

Ernest Hampson, 10, Fir Road, Swinton, Manchester (Head Carder, Holdsworth & Gibb Ltd., Moorside Mills, Swinton, Manchester).

Alfred Edwin Herbert, B.Sc., A.R.I.C., 7, Fieldhouse Road, Rochdale (Chief Chemist, John Bright & Bros. Ltd., Fieldhouse Mills, Rochdale).

Frank C. Hewitt, The Hampton Co., Ferry Street, Easthampton, Mass., U.S.A. (Director of Research and Development).

Ianbeck McLeod Hill, 15, Myrtlefield Park, Balmoral, Belfast (Bleach Works Manager, Milltown Bleaching Co. Ltd., Donacloney, Nr. Lurgan, Co. Down).  
Silk Printers Ltd., Pontypridd, Glam.).

Geoffrey E. Macpherson, St. Mary's Place, Nottingham (General Manager and Director).

- Ralph John Basil Marsden, B.Sc., M.Sc., D.Phil., 57a, Barlow Moor Road, Didsbury, Manchester, 20 (Senior Research Assistant, Rayon Department, British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester).
- William Davies Owen, A.M.I.E.E., M.R.S.T., 15, Savoy Street, London, W.C.2 (Electrical Engineering Research, The British Electrical and Allied Industries Research Association, London).
- Alfred C. Pawson, B.Sc., Technical Institute, Rochdale Road, Todmorden (Principal).
- Phillip Rawnsley, Messrs. David Pike & Co. Ltd., Ebor Mills, Bingley (Director).
- Patrick B. Rhodes, The Lodge, Morley, Yorks. (Director, J. & S. Rhodes Ltd., Morley).
- Bhupes Lobhan Sen, 224, Sir Bhalchandra Road, "Yashodham," Matunga, Bombay, India (Textile Chemist, Messrs. Volkart Bros., P.O. Box 199, Bombay).
- Robert Olin Simmons, Pepperell Mfg. Co., Lindale, Georgia, U.S.A. (Supervisor of Research and Development).
- Cecil Smith, 1, Kenwood Avenue, Leigh, Lancs. (Manager, Grout & Co. Ltd., Pendle Mill, Leigh).
- Ronald Steele, 37, Law Street, Sudden, Rochdale (Assistant Overlooker, Tyte Fabric Weaving, Dunlop Cotton Mills Ltd., Castleton, Rochdale).
- Ted Tillotson, "Glenwynn," Brogden, Barnoldswick (Cotton and Silk Cloth Manufacturer, Edmundson (Fernbank 1936) Ltd., Fernbank Mill, Barnoldswick).
- Albert Edward Verling, "Woodlands," 68, Hampton Road, Forest Gate, London, E.7 (Deputy Chief Inspector Stores Disposals, Ministry of Supply, Hans Road, London, S.W.3).
- Sidney Walker, A.M.C.T., A.M.W.M.A., "Alynwood," 11, Vale Avenue, Godley, Hyde (Assistant Mill Manager, Thos. French & Sons Ltd., Chester Road Mills, Manchester).

#### *Junior.*

- Walter Isidore Braun, 1, St. James Road, Leicester (Student).
- F. A. B. Goldschmidt, 75, South Knighton Road, Leicester (Student, Technical College, Leicester).
- Dennis Arthur Harrison, 214, Stanhope Drive, Horsforth, Nr. Leeds (Laboratory Assistant, Textile Department, Leeds University).
- George Arthur Holmes, 31, Keighley Avenue, Colne, Lancs. (Assistant Designer and Dobby Pattern Pegger, Thos. Hyde & Co., Derby Street Mill, Colne).
- Alan Berkeley Sykes, 4, Clutton Street, Soothill, Batley, Yorks. (At present serving in H.M. Forces).
- John Tyrer, 22, Balliol Street, Crumpsall, Manchester, 8 (Laboratory Assistant, Chamber of Commerce Testing House, Manchester).
- A. E. Watts, 63, Kenyon Street, Abbey Hey, Manchester, 18 (Laboratory Assistant, Chamber of Commerce Testing House, Didsbury, Manchester).

## Obituary

### Mr. W. Wilkinson

William Wilkinson was one of the outstanding personalities of the Lancashire Cotton Industry for many years. He was born in Hebden Bridge in 1882, where he attended the elementary school, subsequently his family removed to Clitheroe where he commenced his working life as a weaver. Taking up technological studies at Clitheroe Technical School, he gained a premier award in the City and Guilds of London Final Examinations in Cotton Weaving, and subsequently a Lancashire County Scholarship, which took him



for two years full-time study in Cotton Manufacture to the Manchester College of Technology.

His industrial working experience in a number of mills in Clitheroe, Nelson and Leigh was wide and varied and, combined with his aptitude for teaching, fitted him in a special degree to fill with distinction what was to be his chief life's work, that of textile technologist and teacher. He commenced his teaching career as an evening teacher at the school where he had begun his technical studies. Later he took up full-time teaching at Clitheroe and Accrington, and in 1912 became Head of the Textile School at Nelson. In 1918 he was appointed Head of the Textile Department at Blackburn Technical College and later Principal of the College, the post he occupied until his death.

A member of the Textile Institute for 25 years, he was elected to a Fellowship in 1926 and continuously from that time he was a member of the Council. Besides serving on many important committees of the Institute he did much valuable pioneer work in Industrial Recruitment and gave many papers to Institute Conferences and Sectional meetings. Outside the Institute's activities he gave many papers to textile bodies, not only in Lancashire and Yorkshire, but in other textile areas. He was the founder of the Blackburn Textile Society, one of the largest of such bodies in the country, and was widely recognised as a textile expert and as one of the leading figures in textile technology and technical education.

He won the esteem of a host of students and others for his genial and friendly disposition, coupled with the high regard for his talents, and it gave much pleasure to many old students and associates when in 1932 he was honoured by the award of the O.B.E. for his outstanding services to technical education.

C. BARNshaw.

### Mr. John Emsley: A notable leader of the Wool-Textile Industry

By the death of Mr. John Emsley, on August 3rd, at the age of 81 years, the wool-textile industry lost one of its outstanding leaders. The Institute owed much to his leadership, and it was during his four years as President that the Institute obtained its Royal Charter, and it was mainly due to his driving force that this object was attained. In recognition of his services he had the honour of being made the first Fellow of the Institute. His dapper figure and his alert and dominating personality radiated enthusiasm and energetic action, and in all his activities for the good of the industry and of the city, he displayed that business acumen which had enabled him to develop and direct the five important enterprises which came within the definition of "John Emsley's Factories." The son of the founder of the firm of J. Emsley & Co., Ltd., stuff manufacturers, of West Bowling Shed, he began work in the mill at the early age of eleven, and three years later, on the death of his father, he became associated with his brother, Robert, in running the business for their mother. He "went through the mill" in every sense of the term, and had a hard struggle in his earlier years. Then the tide of fortune took a more favourable turn, and in later years he added to his responsibilities by taking over the firms of Peel Bros. & Co., Ltd., Globe Mills; John Priestman & Co., Ltd., Ashfield Mills; John H. Smith & Co., Ltd., Broad Lane Mills; and John Speight, Son & Co., Ltd., Broad Lane Mills.

The Bradford Chamber of Commerce also lost one of its most loyal and conscientious members. For two years he was President of the Chamber and for many years up to the time of his death he rendered valuable service in the position of Honorary Treasurer. He was President of the Bradford Textile Society just prior to the last great war, and another trade distinction was his

election as Master of the Worshipful Company of Woolmen. He was also a member of two other City Guilds—the Weavers and the Clothworkers. As senior magistrate he took an active part in the work of the Bradford City Police Court and often presided on the Bench. The Bradford Rotary Club the Bradford Cricket Club, the Bradford Automobile Club and the Bradford Branch of Toc H, all had the benefit of his services, and he was also a Vice-President of the Bradford Royal Infirmary Board. He lived a very full life and showed little or no sign of waning physical powers until after the death of his wife about a year ago. That great loss left its mark upon him, and he did not long survive the passing of his life's partner.

H.J.

### Employment Register

The following announcement is taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:—

No. 139—Young man, 31 years of age, desires administrative post dealing with the technical processing of textiles. A.R.I.C., A.T.I., A.M.I.I.A., A.M.C.T. Higher National Certificate in Chemistry. Many years' experience as chemist and examiner of textiles.

## NOTICES: INSTITUTE MEETINGS

### LANCASHIRE SECTION

Friday, 12th January, 1945—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's premises. "Textile Electrification," F. J. Stevenson (Crompton Parkinson Ltd.).

Saturday, 27th January, 1945—*Manchester*. 2.45 p.m. Lecture: "Colour and Light," by T. Vickerstaff, M.Sc., Ph.D. (I.C.I. Ltd., Dyestuffs Division), at the Textile Institute, Manchester.

### MIDLANDS SECTION

Saturday, 20th January, 1945—*Derby*. 3.0 p.m. Lecture: "Warp Knitting," by C. H. Edwards, M.A., F.T.I., at the School of Art, Green Lane.

### YORKSHIRE SECTION

Thursday, 18th January, 1945—*Bradford*. 6.30 p.m. Lecture: "The Distribution and Movement of Fibres on a Woollen Card," by J. C. Martindale, Ph.D., A.Inst.P., at the Midland Hotel.

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TRANSACTIONS AND INDEX





# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 1—THE DETERMINATION OF THE ACETIC ACID YIELD OF ACETYLATED CELLULOSES

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(British Cotton Industry Research Association)

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#### A. INTRODUCTION AND SUMMARY

The importance of the mean acetic acid yield of acetylated celluloses in influencing the solubility and the dyeing and electrical properties of the materials has always been realised, and numerous methods for its determination have been advocated. For the most part these rely either on acid hydrolysis of the ester followed by determination of the liberated acetic acid, or on alkaline hydrolysis with subsequent titration of the excess alkali. Summaries of the literature have been presented by Marsh and Wood<sup>1</sup>, and Murray, Staud and Gray<sup>2</sup>; more recently Genung and Mallat<sup>3</sup> have compared the Eberstadt alkaline hydrolysis and the Ost distillation methods.

It seems generally accepted that the use of alkali to effect hydrolysis is to be preferred, and most of the recent work is devoted to modifications designed to overcome theoretical objections or to apply to a particular material. The present authors advocate the use of alkali as a hydrolysing agent particularly for routine analysis, and they prefer the methods described below to that published from these laboratories by Parsons<sup>4</sup> in 1933.

The methods employ hydrolysis with sodium hydroxide solution in the presence of sodium chloride for the evaluation of acetate rayons, and hydrolysis with potassium hydroxide in the presence of alcohol for cellulose triacetates or samples difficult to wet or to hydrolyse. Their application to dyed materials which give coloured solutions has been accomplished by the addition of carbon tetrachloride before titration, when in general the dye is absorbed by the carbon tetrachloride, leaving an upper aqueous layer fairly free from colouring matter.

#### B. EXPERIMENTAL

##### Method 1. For Undyed Acetate Rayon

The obvious method of hydrolysing the cellulose acetate with a known amount of sodium hydroxide and determining the excess alkali by titration with standard acid was found to be unsuitable owing to absorption of alkali by the cellulose, which resulted in a poor end-point. This was improved by adopting the usual device of adding a known amount of acid, and after a suitable period of time determining the excess acid by back-titrating with standard alkali. Even this modification was not a sufficient improvement owing to the fact that the regenerated cellulose was in a highly swollen condition, being often in the form of gelatinous lumps that retained the reagents and so hindered accurate titration. Glycerol was found to minimise the

swelling, but the addition of sodium chloride eventually proved to be the most satisfactory means of preventing the cellulosic material from losing its fibrous form.

The experimental technique adopted is as follows:—About 0.2-0.4 g. of the acetate rayon is accurately weighed and its dry weight determined either by drying or by making a moisture content determination on a separate sample (drying for at least 3 hours at 110° C. has no effect on the final result). The material is transferred to a stoppered conical flask, 5 c.c. of saturated sodium chloride solution are added, and 10 c.c. of N-sodium hydroxide run in. The conditions of hydrolysis can be varied to suit convenience or urgency, the flask being left either over-night at room temperature or for a shorter time not less than two hours. On completion of the hydrolysis, 10 c.c. of N-sulphuric acid are added, and after half an hour the solution is titrated with N/10-sodium hydroxide, phenolphthalein being used as indicator. Duplicate determinations and blank experiments are run, and the blank value is subtracted from the observed titrations. The normal alkali and acid solutions do not require to be accurately standardised, but to ensure a positive "blank" the acid should be slightly more concentrated than the alkali. The acetic acid yield is defined as the weight of acetic acid produced by the complete hydrolysis of 100 g. of dry cellulose acetate, and is calculated according to the formula:—

$$\text{Acetic acid yield} = \frac{0.6 \times f \times (T - t)}{W}$$

where  $f$  = factor of the N/10 NaOH

$T$  = actual titre in c.c.

$t$  = blank titre in c.c.

$W$  = dry weight of cellulose acetate used, in grams.

The N/10-sodium hydroxide is standardised against potassium hydrogen phthalate (AnalaR reagent).

Some results obtained by this method are given below, all the figures being the means of duplicate determinations. In order to determine the time required for complete hydrolysis, samples of a commercial acetate rayon were submitted to the standard procedure at 25° C. for various times. The results in Table I indicate that hydrolysis is substantially complete after 2 hours, so that the over-night treatment generally adopted is amply sufficient.

Table I

Time of hydrolysis (hours) .....	$\frac{1}{2}$	1	2	3	6	17 $\frac{1}{2}$	24	41 $\frac{1}{2}$
Acetic acid yield, % .....	45.4	52.5	53.5	53.5	53.1	53.2	53.6	53.3

The method yields accurate results in the analysis of mixtures obtained by adding known amounts of standard acetic acid solution to viscose rayon. Addition of cellulose seemed to increase slightly the apparent amount of acid present in the solution (possibly due to the carboxyl groups in the regenerated cellulose), but the effect is negligible for practical purposes. Table II illustrates these results.

Table II

Weight of dry cellulose added, g. ....	0	0.0960	0.1832	0.2714	0.3581
Weight of acetic acid added, g. ....	0.1526	0.1526	0.1526	0.1526	0.1526
Weight of acetic acid found, g. ....	0.1520	0.1520	0.1519	0.1529	0.1532

In each determination the weight of acid found agrees with that added to within 0.5 per cent., and the experimental error may be regarded as being of this order.

No error was introduced by varying the amount of acetate rayon from 0.1 to 0.4 g. (Table III).

Table III

Weight of dry cellulose acetate used, g. ...	...	0.1171	0.1965	0.2843	0.3933
Acetic acid yield, %	...	54.0	54.5	54.4	54.2

Heating the acetylated cellulose with alkali in order to increase the speed of hydrolysis is not to be recommended because other acidic products are formed, as was also noted by Genung and Mallat<sup>2</sup>. For instance, viscose rayon treated with *N*-sodium hydroxide at 40° C. and at 70° C. for 1 hour gave apparent acetic acid yields of 1.6 per cent. and 4.8 per cent., respectively, whilst a sample of acetate rayon hydrolysed at 100° C. for 1 hour showed an acetic acid yield of 57 per cent.

The method described above can also be satisfactorily applied to commercial samples of cotton acetylated to approximately 30 per cent. acetic acid yield (Cotopa 30). The figures (obtained at room temperature) given in Table IV illustrate this; it should be noted, however, that with such materials it is not really necessary to add salt, for the fibres do not swell greatly in alkali.

Table IV

Time of hydrolysis (hours) ...	$\frac{1}{2}$	1	2	4	6	17	48	168
Acetic acid yield, % ...	24.2	26.6	26.5	27.6	27.9	27.8	27.5	27.5

#### Method 2. For Dyed Acetate Rayon

In routine work dyed materials are frequently encountered which on hydrolysis so colour the solution that titration in the ordinary way is impossible. The alternative procedures of stripping the dye from the material before making the determination or of doing an electrometric titration are extremely inconvenient, and the method here described imposes but little alteration of the existing technique and requires no extra time.

The analytical method is identical with that described above for undyed yarns as far as the actual titration stage, when 15 c.c. of carbon tetrachloride are added to the flasks (including the blanks), which are then stoppered, shaken vigorously for about half a minute, and the titration continued as before. Carbon tetrachloride is a dense non-inflammable liquid which generally absorbs practically all the dye from the aqueous solution and forms a separate layer at the bottom of the flask. Further dilution with water may be necessary if complete absorption of dye from the aqueous layer has not taken place. It is helpful in these titrations to support behind the titration flask a piece of mirror so tilted that the flask can be seen from the side; with this arrangement the coloured carbon tetrachloride layer does not interfere with the perception of colour change in the aqueous layer. Phenolphthalein can be used as indicator in all experiments except those in which a pink or red aqueous solution remains after carbon tetrachloride extraction. Here it is advisable to employ Bromthymol Blue (0.5 per cent. solution in 20 per cent. ethyl alcohol, 80 per cent. water) which is yellow in acid solution, passes through green, and then suddenly changes to deep blue. The green colour here serves to indicate the proximity of the end-point.

Application of this method to undyed samples of acetate rayon showed that adding carbon tetrachloride in no way altered the value of the acetic acid yield. The method was then tested on some fifty samples of acetate rayon dyed with representatives of the following classes of dyes:—Artisil, Cellitazol, Celliton, Cibacet, Dispersol, Duranol, Ionamine, Setacyl, Solacet, and S.R.A. Most of the shades were heavy, and with at least half of them the ordinary methods would have failed. Acetate rayons hydrolysed and dyed with direct dyes, samples of vat, azoic, and direct-dyed viscose rayon and cotton, and samples of acetylated cotton dyed with vat and acetate rayon colours have been tested successfully, although in many of these there was but little discoloration of the solution. In addition, however, this method was successfully applied to various samples of acetylated cellulose which gave very dark solutions on hydrolysis. No claim is made that the proposed modification will always allow the end-point of the titration to be detected with a visual indicator, but so far no materials have been encountered to which the method could not be applied.

The used carbon tetrachloride may be purified by the usual methods of distillation, or more simply by shaking with aluminium oxide, activated charcoal, or silica gel, and filtering. A second shaking with the solid will produce a perfectly clear filtrate. Aluminium oxide and activated carbon are more satisfactory than silica gel, and of these the former is to be preferred in that after roasting it may be used again.

### Method 3. For Materials Difficult to Hydrolyse

Certain types of acetylated cellulose, such as cellulose triacetates and fibrous, highly-acetylated cottons, are not easily hydrolysed, and it seemed desirable to investigate an analytical method for these materials since they are becoming more widely used, particularly in the electrical insulation field. The experimental technique described below follows the same general principles as Method 1. From work done in these laboratories it has been shown that potassium hydroxide solutions hydrolyse cellulose acetate rayons more rapidly than sodium hydroxide solutions of the same normality, and consequently *N*-potassium hydroxide is employed in this method as the hydrolysing agent. One other essential requirement is to ensure rapid and complete wetting of the acetylated cellulose, and this is accomplished by dissolving the alkali in a medium composed of equal volumes of water and methyl or ethyl alcohol.

The technique employed is identical with that described for Method 1 except that *N*-potassium hydroxide in the water/alcohol solvent is used as the hydrolysing agent, and no salt is added. Dilution with water before titrating is advocated, otherwise the alcohol may cause slight fading of the indicator. This method can of course be used for secondary acetate rayons, and by using it for these materials the time of hydrolysis can be reduced to about 1 hour.

The time required for complete hydrolysis of secondary acetate rayon was found by using the technique of Method 3 on 0.25 g. samples of a commercial material for various times at 25° C. The results in Table V indicate that hydrolysis is substantially complete after half an hour.

Table V

Time of hydrolysis (hours) .....	$\frac{1}{2}$	1	2	3	6	17 $\frac{1}{2}$	24	40 $\frac{1}{2}$
Acetic acid yield, % .....	53.4	54.0	53.5	53.7	53.6	53.6	53.3	53.8

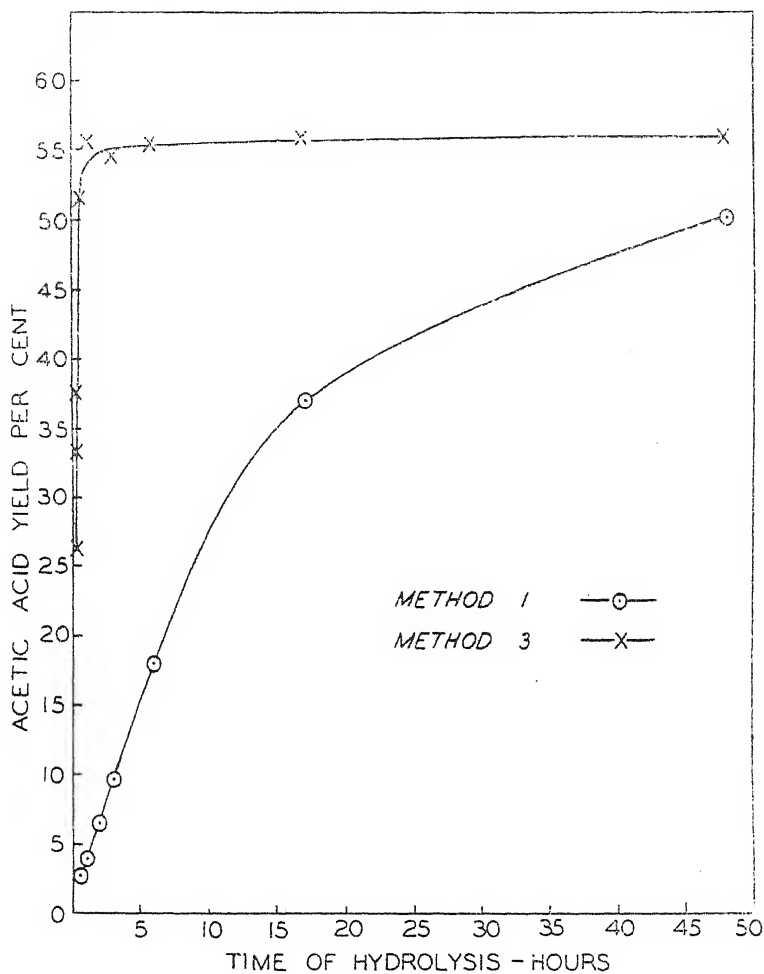


Fig. 1

Method 3 was, however, developed for the rapid hydrolysis of difficultly-hydrolysable materials, and to test it for this purpose Methods 1 and 3 have been compared by applying them to a fibrous, highly-acetylated cotton. The results in Table VI and Figure 1 show the great advantage of Method 3 for this purpose, and emphasize the slowness of aqueous sodium hydroxide as a hydrolysing agent in this connection. The results were obtained at room temperature.

Table VI

Method 1		Method 3	
Time (hours)	Acetic acid yield, %	Time (hours)	Acetic acid yield, %
0.5	2.6	0.083	26.5
1.0	4.0	0.167	33.5
2.0	6.6	0.25	37.6
3.0	9.8	0.5	51.7
6.0	18.1	1.0	55.2
17.0	37.2	3.0	54.7
48.0	50.1	6.0	55.4
168.0	55.5	17.0	56.1
		48.0	55.9
		168.0	56.7

From a consideration of Tables I, IV, V and VI it is clear that for secondary acetate rayons and partially esterified cottons Method 1 will cause complete hydrolysis in 2 and 4 hours, respectively, whilst Method 3 needs only 1 hour. It is emphasized that for routine work, however, where samples of different properties are encountered and where dilution of the hydrolysing alkali often occurs through washing the cellulose material down the sides of the flask, an over-night hydrolysis is to be preferred. For such an over-night treatment, dilution with 20 c.c. of water has no effect on the final result.

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 2—SOME OBSERVATIONS ON THE MEASUREMENT OF STRETCH OF ELASTIC WEBBINGS

By G. H. LUNGE, M.A., D.Sc., F.I.C.

#### SUMMARY

The work described in this paper was undertaken to ascertain the most suitable conditions for the measurement of stretch of elastic webbings.

The experimental conditions, the length of the test sample, the time factor during loading and unloading, the preparation of the web and sampling are examined.

The importance of the elastic-limit as applied to webbing is discussed and a method of finding this limit is described.

The practical use of the information obtained is then discussed and suggestions are put forward for standards to be adopted for tests.

#### INTRODUCTION

Elastic webbings are composed of an assembly of textile yarns and rubber and each component has its own particular physical characteristics. These characteristics for rubber thread and cotton and rayon yarns have been studied and recorded. The object of this paper is to record some of the more interesting results of the study of the behaviour of elastic webs and to point out where these composite bodies conform to and where they differ from the yarns acting individually. A further object is to ascertain what standards it would be useful to adopt in the industrial control laboratories when recording stretch observations.

It is an established fact that when rubber is stretched and relaxed repeatedly each operation has an effect on the subsequent operation. It is suggested that this is due to the overlapping of the "after-effect." In practice this means that no two consecutive measurements of stretch or unloading are exactly the same. In an elastic web there is the additional reaction of the rigid yarn envelope woven around the rubbers and the slipping or frictional effects which go on when the elastic web is stretched. These additional effects modify the normal reactions of the rubber, so that although the basic observed facts about rubber still hold to a certain extent, it is necessary to study the features of elastic web and note such modifications as occur.

#### The Elastic Web

The nature of the rubber thread used in elastic web has an effect not only on the appearance, but also on the weight and extensibility of the web. It has therefore been thought useful to indicate in each experiment cited the kind and size of rubber thread used.

These threads are produced in two ways—by cutting thin strips from sheet rubber or by extruding rubber solution or latex through circular nozzles—and are known respectively as "cut" or "extruded." Cut threads have a rectangular section, two opposite faces having a serrated appearance due to the uneven action of the cutting knife. Extruded threads have a round section and a smooth surface.

The count is the number of threads which placed side by side will cover an inch scale. Thus the count of a square thread in which each side measures 0.02 inch or a round thread with a diameter of 0.02 inch, is 50's. Since the two kinds have a different weight for the same count, it is usual to indicate

the round thread count by two figures, the first denoting the diameter and the second the equivalent or count of a square thread having the same cross-sectional area; thus, 50/56 count (i.e.,  $50 \times 1.13 = 56$ ).

A plain rubber thread is referred to as "naked."

Many rubber threads have a spiral covering of some textile material and are referred to as "covered" or "double covered" when wound with two layers.

A full account, by Professor William Davis, of the properties of rubber threads, including measurement of count and a description of covering, has appeared in the *Journal of the Textile Institute*, 1933, Vol. XXIV, pages T.44-53.

#### EXPERIMENTAL CONDITIONS

Measurements of extension and contraction were made on elastic webbing suspended vertically, weights being added or subtracted, on a hook attached to the lower end of the web. Care was taken when adding or subtracting a weight to prevent the web from jerking to its new position as this would falsify the results. The difficulty experienced by workers on rubber thread in producing an effective non-slip grip are not so evident with webbing. Ordinary screw clamps with grooved faces and two pads of flat rubber will secure a grip which will not slip even when the tension reaches the breaking point, on a Schopper or like machine. The quickest set-up and most effective grip, as used in these experiments, was a pin stenter plate, as shown in Fig. 1.

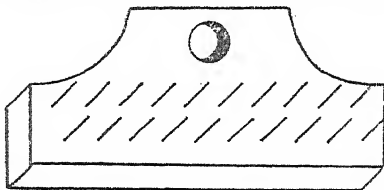


Fig. 1

By means of the hole, the plate can be screwed to the cross bar of a supporting framework and when used as the lower grip the hole serves to hold the hook on which either a scale pan or the weights can be added directly. A sharp tap with a stiff brush impales the webbing on the pins and there can be no slip.

The weight of the lower grip and hook must of course be taken into account.

Two lines were marked across the webbing at a fixed distance apart and the changes in length measured to 0.05 of an inch. However fine the gauge line is marked on the web it will be found that as the web stretches so the mark increases in width, and to make observations to any finer degree did not appear either useful or accurate.

In order to ascertain whether this seemingly crude method of loading and unloading the web gave accurate results, a machine was constructed on the principle of the incline-plane. A loaded carriage, to the rear of which was fixed a clamp holding one end of the web, moved steadily along a set of rails as the angle of slope was increased. A pointer attached to the carriage indicated changes of length on a scale fixed to the rails. It was found that the extension-load and -unload curves obtained by both methods were co-incident. The disadvantage of the machine was the great length of plane required for highly extensible webbings, so that the method of adding weights to a vertically suspended web is preferred.

#### The Length of the Sample

It has been stated that when measuring the extensibility of rubber, the length of the sample has no effect on the result. It was thought that with elastic webbing the length would have an effect, since there is not only the stretch of the rubber to be considered, but also the friction of the com-



ponents of the woven system on each other when they move. Numerous experiments were made on lengths from 3 to 24 inches but within the limits of measurement used, no difference was observed. For convenience, a length of 6 inches was adopted, this also being the length generally stipulated in Government specifications for test samples. The length was afterwards changed to 5 inches to facilitate subsequent calculations. Further experiments showed that more accurate and consistent results were obtained if at least 3 inches were left between each mark and the adjacent clamp.

#### Time

The time that elapses between making an addition or subtraction of load and making a measurement is of great importance. In general the stronger the web the greater the time required to reach equilibrium. Webs vary greatly and some outstanding cases are recorded in Table I:

Table I  
Progressive Stretch of Typical Elastic Webs

Rubbers:—	12 ends; 20's flat; double covered	14 ends; 50's square cut; single covered	8 ends; 50's square cut; single covered
Type of web:—	1 in. Chin-strap, heavy type	$\frac{7}{8}$ in. Medium type	$\frac{1}{2}$ in. Light web
Load:—	3 kilos	1 kilo	200 gms.
Percent. increase in length.			
On loading...	56.7	80.0	66.7
After $\frac{1}{2}$ minute	58.3	80.8	68.3
" 1 "	58.3	80.8	68.3
" 3 "	59.2	81.0	68.7
" 15 "	60.0	81.7	70.0
" 2 hours	61.7	83.3	70.8
" 5 "	62.5	83.3	70.8
" 20 "	63.3	83.3	70.8

If a web is loaded for a second time after release to rest and all visible residual extension has disappeared, it will be found that the time required to reach equilibrium is considerably shorter. This point should be remembered when deciding the standard time to be adopted.

Table II records the results of an experiment in which an elastic web was loaded and unloaded three times. The time required to reach the maximum stretch for each load was recorded but the next load was not applied until it was obvious that on further change in length was going to take place. The unload figures were taken in the same way. The sample was pre-stretched by hand and allowed to rest for 2 hours.

Table II  
Stretch after Repeated Loading

(1 in. Chin-strap; 12 ends rubber, 20's flat, double covered)

Load, Kilos	Loading		Unloading		Loading second time		Unloading second time	
	% Stretch	Time	% Stretch	Time	% Stretch	Time	% Stretch	Time
0	—	—	Zero	2 hrs.	—	—	Zero	1½ hrs.
$\frac{1}{2}$	1.7	$\frac{1}{2}$ min.	12	2 mins.	1.7	$\frac{1}{2}$ min.	8.3	30 mins.
1	10.0	$\frac{1}{2}$ "	31.7	2 hrs.	14.2	$\frac{1}{2}$ "	25.0	40 "
1½	35.0	$\frac{1}{2}$ "	83.3	61 mins.	43.3	$\frac{1}{2}$ "	75.0	25 "
2	55.0	1 "	95.8	27 "	65.0	$\frac{1}{2}$ "	92.5	2 "
2½	68.5	2 "	99.2	2 "	78.3	$\frac{1}{2}$ "	96.7	2 "
3	77.5	2 "	100.8	2 "	85.8	1 "	99.2	2 "
4	86.7	10 "	102.5	2 "	93.3	1 "	101.7	2 "
5	93.8	14 "	103.0	2 "	98.3	2 "	104.2	2 "
7	100.8	21 "	104.2	2 "	102.5	2 "	105.0	2 "
9	105.0	30 "	105.8	17 "	105.0	5 "	105.8	2 "
10	106.7	2 "	—	—	106.7	5 "	—	—

A third and fourth set of loadings and unloadings gave the same figures as series 2. This has also been found to hold for every other kind of webbing tested and it makes no difference whether the web has been sized or not.

It will be noted that, with loads of 9 and 10 kilos the extensions are the same for the first, second and subsequent series of loadings, although during the second loading there is greater extensibility than during the first loading, up to 9 kilos. It would appear as though the first loading had broken down some stiffness which was resisting stretch. The third and subsequent loading and unloading give the same results as the second. This is perhaps contrary to the behaviour of rubber which is modified by each operation. It can be explained by the fact that there is the rigid fibre envelope acting as a brake and also that the degree of accuracy of measurement cannot be finer than to 0.05 of an inch.

Generally, the elastic web manufacturer is only interested in the stretch-load up to the limit of useful extension, a point which will be defined later on. This limit was reached in all samples tested so far within the 2-minute period. It should therefore be possible to use this period as the standard time to elapse between adding a load and making a measurement. The portion of the unloading curve which is of interest also lies in the 2-minute series.

Since the elastic webbing, when in use, will be repeatedly stretched and relaxed, it must be the second or ultimate figures which are recorded. It should therefore be possible to bring the webbing into a state where loading and unloading will give the figures for the second series first time, thus saving valuable time in the control laboratory. Various loads were therefore applied for various times to the web, stretching it to 50 per cent. extension, 100 per cent. extension and extensions to nearly the maximum. The webs were then allowed to rest for various times and a series of stretch-load experiments made. In every case tried so far the second series of loadings has been different from the first and the third series substantially equal to the second.

If, however, the web is submitted to repeated stretching and unstretching, within the limit of the loom stretch, it will be found that the second and third series of loadings and unloadings are substantially equal to the first series.

A particular web was stretched by hand 25 times without passing the elastic limit and two series of loading and unloading experiments performed. The maximum difference between the two series was reduced to 2 per cent. The experiment was repeated with 100 stretches but the result was substantially the same as with 25 stretches, the difference still being 2 per cent. In both cases the variation was rather more than twice that which could be put down to experimental error.

Samples were therefore attached to the batten of a loom and stretched 5,000 times. Two series of load and unload curves now coincided very closely and any difference was smaller than the experimental error. After 15 hours' rest the sample was again attached to the loom and subjected to a further 5,000 stretches. The load—unload curve again coincided with that obtained after the first 5,000 stretches.

#### Sampling

If a strip of 10 feet of webbing is cut up to make 10 samples of equal length, and the stretch of the middle 6 inches of each recorded for various loads, it will be found that there is variation between the samples. One such experiment is recorded in Table III. The time between loading and measurement was 2 minutes.

If the average of any three columns is taken it will be found equal to the average of the 10 columns within the limits of the experimental error. It would therefore seem necessary to take at least 3 adjacent samples and average the results when given a strip from which the load-stretch characteristics are required.

Table III  
Variation between Test Specimens  
(1 in. Chin-strap; 12 ends rubber, 20's flat, double covered)

Load, Kilos	Extension in inches										Average
	Sample 1	2	3	4	5	6	7	8	9	10	
0.5	0.3	0.15	0.2	0.2	0.2	0.2	0.15	0.15	0.2	0.15	0.19
1.0	0.5	0.4	0.35	0.4	0.4	0.4	0.45	0.5	0.4	0.45	0.425
1.5	1.5	1.65	1.35	1.4	1.3	1.4	1.35	1.35	1.4	1.4	1.43
2.0	2.5	2.45	2.4	2.25	2.2	2.25	2.2	2.3	2.2	2.3	2.305
2.5	3.0	3.05	3.0	2.9	2.9	2.9	2.7	2.85	2.8	2.95	2.905
3.0	3.4	3.35	3.5	3.3	3.15	3.3	3.15	3.25	3.2	3.3	3.29
4.0	3.9	3.95	4.0	3.85	3.65	3.8	3.65	3.75	3.7	3.85	3.81
5.0	4.3	4.35	4.3	4.3	4.05	4.15	4.05	4.15	4.05	4.2	4.19
6.0	4.45	4.55	4.5	4.5	4.3	4.4	4.2	4.3	4.25	4.4	4.385
7.0	4.6	4.65	4.7	4.65	4.4	4.5	4.4	4.45	4.4	4.5	4.525
8.0	4.7	4.75	4.8	4.8	4.5	4.6	4.5	4.6	4.55	4.7	4.65
9.0	4.8	4.9	4.95	4.9	4.6	4.7	4.6	4.65	4.6	4.75	4.745
10.0	4.9	4.95	5.0	5.0	4.65	4.75	4.65	4.75	4.6	4.85	4.83

Experiments have also been made to ascertain the irregularity of samples taken from several looms. In the experiment recorded by the graph, Fig. 2, two samples were taken from the right and left side of 12 looms. Each loom had 24 spaces.

It was necessary to average 10 samples in this case. The web was a very difficult one to make without variation so that it may be considered an extreme case. If careful attention is paid to even rubber covering, even warping and even tensions on the loom, in general the results are very much more consistent than are shown in Fig. 2.

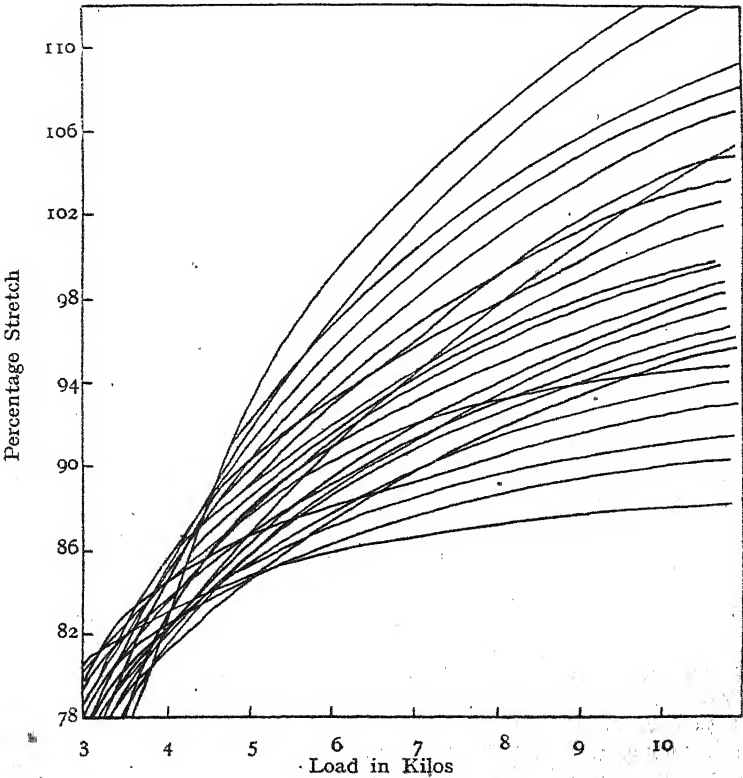


Fig. 2



naked, are stretched by beam weighting. According to the amount of tension on the rubber threads so the elastic properties of the web vary. When the woven elastic web leaves the "take-down" rollers, the rubber being under tension contracts, draws the web picks closer together and cockles up the warp threads, so that what would have been 1 foot of web at stretch on the loom may be only 5 or 6 inches in length when it leaves the loom. The rigid warp threads are also woven under tension. Therefore, the stretch of an elastic web is from rest to the extended position it occupied on the loom. Further stretching is possible to a very limited degree but it is the rigid warp threads which have to stretch, and very soon it will be found that the rigid yarn fibres start to stretch and the elastic web has passed its elastic limit and will not return to the original length at rest.

There is, therefore, an "Elastic Limit" for webs far removed from the breaking point. It is dependent not on the rubber but on the rigid textile material components. A 1-inch elastic chin-strap web reaches its elastic limit under a load of about  $3\frac{1}{2}$  kilos. Weights up to about 15 kilos can be added and there will be only a very small increase in stretch. After this point, further loading alters the web structure. The web will not break until the load reaches about 60 kilos. If the load is removed just before rupture occurs, a 6-inch sample will immediately contract to about 6.5 inches. It will then slowly contract to 5.5 inches, which is less than the original sample length. The restraining influence of the rigid envelope has broken down due to fibre stretch and the elastic is free to contract and pull in the web structure to a greater extent than before.

The maker-up of clothing that contains elastic webbing requires an elastic which in use will show no residual extension. It would be quite useless to make a corset, for example, from a fabric with unsuitable stretch characteristics, so that when worn the garment suffered from residual extension and only fitted at intervals, when the residual extension had disappeared. He wants a fabric which will stretch to a required degree and return to the same original length when the load is released.

Strong elastic webbings such as are used for the chin-straps of steel helmets and for corsets do not show any residual extension until loaded so that the web stretches past the length at which it was woven. This length may be termed "the loom stretch." Loading to produce stretch past the loom-stretch introduces an elastic after-effect and the time that it takes for the web to return to normal increases as the load increases.

Weak elastic webbings usually display a small residual extension even under small loads. It has been found that the amount of this extension is constant up to loom-stretch and that it then starts to increase.

Table IV  
Loom-stretch of Elastic Webs

$\frac{1}{2}$ in. Weak elastic, 8 ends, 50's square, single covered			$1\frac{1}{2}$ in. Medium elastic, 28 ends, 54/60 extruded, double covered			$\frac{3}{4}$ in. Strong elastic, 8 ends, 20's square, double covered		
Load, grams	Load extension	Unload extension	Load, grams	Load extension	Unload extension	Load, kilos	Load extension	Unload extension
360	2.1	0.25	360	0.9	0.2	1	1.4	0
560	4.5	0.25	660	2.95	0.2	2	3.4	0
860	6.4	0.25	860	3.6	0.2	3	4.2	0
1060	7.2	0.25	960	3.7	0.2	$3\frac{1}{2}$	4.5	0
1360	7.7	0.25	1160	3.9	0.3	4	4.65	0.1
1560	7.7	0.25	1260	4.0	0.35	5	4.9	0.15
1860	8.2	0.25	—	—	—	—	—	—
2660	8.25	0.3	—	—	—	—	—	—
2160	8.3	0.35	—	—	—	—	—	—
Loom-stretch, 8.2 inches			Loom-stretch, 3.75 inches			Loom-stretch, 4.5 inches		

Table IV shows this effect for three different strengths of elastic web. Each load was removed and the unloaded length measured before an additional load was added. The samples were 5 inches in length, and the loading and measuring interval was 2 minutes.

There is therefore for the elastic web manufacturer a very real elastic-limit, which he requires to know. It is not the limit to which the elastic will stretch, but it is the limit to which it should be required to stretch in actual use. It can perhaps be defined as the "Limit of useful extension." It is the same as the loom-stretch.

One method of estimating this limit is to load and unload until a change occurs in the residual extension. Another method, used in practice, is to mark two lines on the webbing at 3 to 6 inches apart, and then pull out the webbing by hand alongside a ruler and note the extension. According to the strength of wrist and the amount of jerk given, so the result can be varied as much as 20 per cent. It is therefore essential to use a standard method for measuring this stretch.

It has been found that if the load- and unload-extension and contraction curves are drawn, then the point of the limit of useful extension can be found graphically. Fig. 3 shows a typical load and unload curve for a 1 inch elastic web, 12 rubbers, 20's flat, double covered. It resembles the curves obtained for rubber.

To obtain the point of the limit of useful extension, the tangent  $OA$  is drawn to the *unload* curve. The angle  $AOY$  is then measured and reproduced on the ordinate as  $BOX$ . A line is then drawn parallel to  $OB$  touching the unload curve at  $C$ . The extensibility at  $C$  is a measure of the limit of useful extension and though admittedly found by an arbitrary construction, has been found in all cases measured so far to correspond with the loom-stretch. The axial units must be so selected that the slope of the tangent from the origin is not greater than 25 degrees.

A further difficulty which has to be faced when measuring elastic web characteristics is that from the moment the web leaves the take-down rollers and the loom tension is released, it gradually contracts in length. This effect may continue for several days and depends on the particular structure of the web and nature of the rubbers. Preliminary investigation shows that the contraction of some webs in the first 24 hours is as much as 5 per cent., and may be a further 1 per cent. over the next seven days. Since the web is generally stored for a period before being used, it is obvious that stretch measurements made shortly after weaving will no longer hold good for the web at a later date. Web should therefore remain in the laboratory for seven days before it is tested.

It is customary in the elastic web trade to satisfy the customer by giving him an extra 2 or 3 yards in excess of the quantity marked on the ticket, such excess depending on the length of the roll. The quantity is arbitrary but in view of the disclosure that various webbings, according to their structure, contract by different amounts, each quality should be tested for contraction and the allowance laid down as standard. As a further refinement the allowance should vary in accordance with the number of days that have passed since the web was processed.

It has further been ascertained that generally the contraction is greatest at the ends of a strip and least in the middle. Thus a strip 12 yards long on which each yard division was marked gave the following measurements from one end after 7 days:—34.4, 34.4, 35.0, 35.1, 35.1, 35.2, 35.1, 35.1, 35.0, 35.0, 34.9, 34.2. (Web  $\frac{1}{2}$  inch, 10 rubber ends, double covered extruded, 80's count). The total loss was 16.5 inches in 12 yards or 3.8 per cent. On the other hand, another 1 inch web having 12 rubber ends of double-covered 20's flat, gave the following figures for the marked yard-lengths on

the strip after 5 days :—34.5, 34.0, 33.9, 33.8, 34.0, 33.9, 34.0, 34.1, 34.1, 34.6. The total loss was 19.1 inches in 10 yards, or 5.3 per cent. The contraction in this case is therefore least at the ends, and in view of this discrepancy, further work is required to ascertain if there is any rule governing this effect.

As far as investigation has gone it would appear that strong elastic webs contract much quicker than weak ones. Fig. 4 shows the graph of the load and unload curves of a  $\frac{3}{4}$  inch elastic web with 12 ends of war-grade rubber, single covered, cut square, 50's count, immediately after processing and after an interval of 7 days. The loss in length was 4.2 per cent.

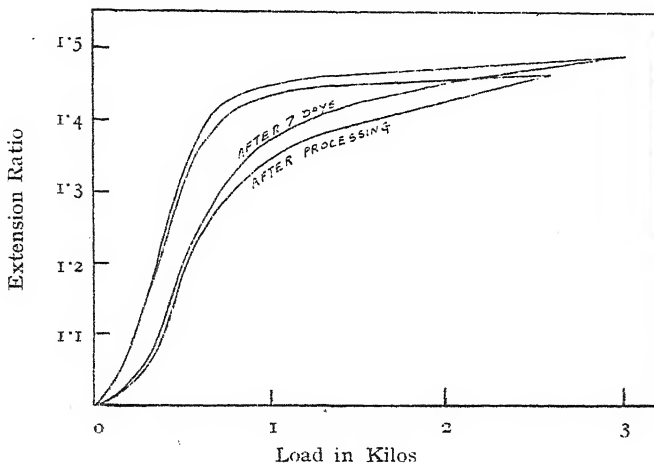


Fig. 4

#### DISCUSSION

Since it is recognised that elastic webs vary considerably from piece to piece, it may be argued that there can be no practical value in studying their behaviour so closely as herein described. It is not suggested, however, that every time a web is sent to the laboratory for a control test, full curves of loading and unloading should be drawn. Each quality of elastic webbing should be studied fundamentally and as accurate a graph as possible drawn of its load and unload characteristics. For this to be of any value, certain standards must be adhered to, so that the inaccuracies of haphazard testing, which have been shown to occur, are eliminated. Having drawn the basic curves from observations on a standard sample, it will only be necessary for future control purposes to make one or two measurements.

Referring back to Fig. 3, *OFC'PCO* represents the load and unload curve of a web selected as being standard for a particular quality. In order to control the works output it will be sufficient to make one or more observations of stretch. The point *C* has been determined graphically as the limit of useful extension. The point *D* represents the load at which this limit is reached. The distance *OG* represents the extension ratio attained by the web if loaded with a weight corresponding to the distance *OD*.

This gives, then, the first and most important control point: a certain load acting for a fixed time shall produce a certain extension. This will in many cases be sufficient control. It could happen, however, that if the full curve of the sample under test were drawn, it might come out as the dotted line *OE*. The condition of passing through the point *C'* has been satisfied but up to this point the sample is stiffer than the standard. A second point, *F*, on the curve *OFC'PCO*, might therefore be selected, and the sample might be required to show the corresponding stretch at that load.

### CONCLUSION.

In conclusion it should be stated that this work does not pretend to be exhaustive as regards the stretch of elastic webs. The subject has been opened up and the more interesting points noted for future deeper study. Enough does appear, however, to have come to light to make it possible to put forward suggestions for the basis of standard test conditions. A start has always to be made, so the following are offered for criticism.

1. The extensibility shall be recorded as the ratio of the stretched length to the length at rest.
2. Five inches shall be marked off on the web sample with fine ink lines drawn at right-angles to the edge of the web.
3. The type of grip is immaterial, but there shall be at least 3 inches between the edge of the grip and the nearest ink line on the web.
4. When single measurements are to be made of the extension under a given load, than the load should be applied for 2 minutes before the measurement is made.
5. When single measurements are to be made of the extension under a given load, the experiment should be repeated, after allowing the web to return to its original length, until a constant result is obtained.
6. It shall be assured that 7 days have elapsed from the date of weaving or finishing, in the case where webs are subjected to subsequent sizing and heat treatment, before stretch measurements are undertaken.
7. When making observations to construct an extension-load and unload curve, 2 minutes interval shall be allowed between the addition or subtraction of a load and the observation of the measurement.
8. For any one strip of web, three sets of measurements shall be made on adjacent parts of the strip and the average results recorded as the stretch.
9. When sampling from a mass of web taken from various looms and beams, at least 10 samples shall be tested and the average recorded as the stretch.
10. The limit of "useful extension" shall be defined as the point on the load-extension curve at which any further increment in load produces an increment in the residual extension.

### ACKNOWLEDGMENT

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 3—NEP FORMATION IN WORSTED CARDING \*

By P. P. TOWNEND, and E. SPIEGEL.

#### INTRODUCTORY

Modern methods of wool combing demand that the wool be fed to the comb in a sliver form. Scoured wool is transformed from its loose lock state to the sliver by one of two processes—carding or preparing. The choice of process is primarily governed by the staple length of the wool, the longer fibres of, say, 9 inches or more, being passed through the preparing process whilst the shorter fibres are carded. Since there is a direct relationship between length and diameter of wool fibres, it follows that the preparing process is confined to the long coarse fibres, whilst carding converts the shorter fine fibres to a sliver suitable for combing. This paper is confined, in the main, to the carding process and has particular reference to the processing of merino wools of 60-70's quality.

A worsted card sliver is judged by two major standards (*a*) the degree of fibre breakage which has occurred during the process, and (*b*) by the clear appearance of the sliver leaving the back doffer of the machine. The extent of fibre breakage will affect the tear of the wool during combing, a subject of very great importance, but this paper is concerned with nep formation and fibre breakage will, therefore, only be discussed in so far as it affects nep formation.

A cloudy sliver might result from two causes: the presence of vegetable matter, and the presence of neps. The causes and mode of removal of the former fault are fairly obvious, but the origin of neps is more obscure.

The precise causes of nep formation are extremely difficult to elucidate since the process of carding, where they first make their appearance, is a combination of many actions and it is impossible to isolate the effect of each one in turn. Kraus<sup>1</sup> carried out a fairly comprehensive survey of the problem, using a Continental card, which differs from the standard Bradford model in that the licker section of the British machine is replaced by a breast complete with workers and strippers. It can be argued that the carding actions of these opening sections are not the same so that some of Kraus' experiments have been repeated on the Bradford card; these, together with his conclusions, will be dealt with in the experimental section.

Microscopic examination of neps reveals that the majority are clusters of fibres, knotted together or twisted round one another, forming little balls of fibre. There are a few, but they are definitely in a minority, which possess a nucleus of vegetable matter or grease, around which the fibres are bound.

A length analysis of the fibres going to make the nep shows that 70 per cent. of them are below 2 cms. Fig. 1 shows the length-frequency distribution curves of the fibres of a normal card sliver and the neps extracted from this sliver. This graph might be misinterpreted to conclude that short fibres

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\* The substance of this paper was delivered as a lecture to the Yorkshire Section of the Textile Institute at Bradford on October 21st, 1943.

are responsible for the formation of neps, were it not for the work of Kraus. He took a combed top and dyed 10 per cent. of it in a cold liquor to a blue colour. The dyed top was then cut into small lengths of 10-20 mm. and mixed with the remaining 90 per cent. of undyed white top by means of a teaser. When the mixture was carded no blue neps could be found in the card sliver, showing that neps do not necessarily result from the presence of short fibres in the blend, but that the shortness of their length is due to fibres being broken off the main body of the nep as it passes through the machine.

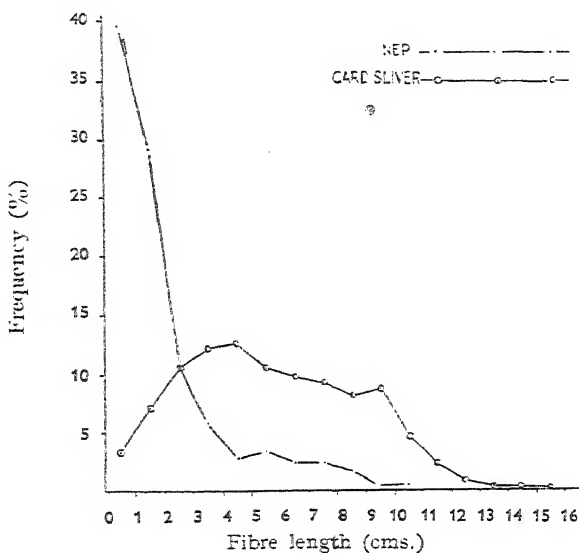


Fig. 1

The diameter of the fibre is not, however, without importance, for Kraus has shown that the fibres constituting the nep are on the average 35 per cent. finer than the normal ones in the card sliver. He confirmed this point by considering the relationship existing between wool quality and neppiness, as shown in Table I.

Table I

Wool quality	Neps per unit weight of card sliver
Australian, 64's-70's ...	1466
" " 58's-64's ...	1135
New Zealand, 58's ...	640
" " 56's ...	410
" " 50's ...	277
" " 46's ...	204

Two factors are probably responsible for this increase in neps with increasing quality of wool, viz., the tendency of fine wool fibres to mill or matt together and the use of an emulsion scouring system to clean greasy wool. Speakman and Stott<sup>2</sup> have shown that a fabric made from an 80's quality wool will shrink 43.2 per cent. in its width, whilst a 56's wool fabric shrinks only 26.3 per cent. This ability of the wool fibre to matt is well known and it is also known that the fibre, regardless of quality, will matt more in certain alkaline solutions than in others. Milling of the fibres is at a minimum in the region of pH 4-8 and gradually increases with rise in pH. Emulsion scouring takes place in the region of pH 10, so that any agitation

given to the wool will tend to exaggerate the matting of the fibres. The form of scouring used in the case of fine wools is such as will impart the least agitation to the fibres, but it is obvious that some agitation is necessary or the dirt cannot be removed. Fine wools are, therefore, unavoidably matted in the scouring process: this matting is a fault and a well-scoured wool is expected to be clean and lofty, but it is obvious that some fibres will tend to felt together and form the nuclei for neps. Examination of scoured wool does not show any neps, as such, but there is a tendency for the locks of wool to be rolled together and these are probably the nucleus of the subsequent nep. In keeping with the preceding argument, Kraus has shown that the emulsion scouring system is responsible for a large proportion of neps. A summary of his results is given in Table II.

Table II

Method of washing	Neps per unit weight
Hand washed, using soap and soda ... ..	225
Hand washed, using benzene ... ..	305
Machine washed, using soap and soda ... ..	1125
Machine washed, using soap and soda, but no pressure applied to the top squeeze rollers ...	982

They show that the matting of the fibres by the machine is responsible for the very large increase in nep formation, compared with that obtained when a gentle hand washing was applied. It is also interesting to note that a reduction of the pressure on the wool by the squeeze rollers causes a reduction in the number of neps, no doubt because the squeeze rollers operating under a load of 4-8 tons, are bound to have a felting action on the wool as it passes between them. It would appear, therefore, that the emulsion method of washing wool should give way to a better system, but up to the present no other method can compete with it as regards simplicity and cost, so that the worsted scourer and carder finds himself in the unenviable position of knowing that the present system is unsatisfactory, that it is the basis of nep formation, but is unable to alter the state of affairs. There is no doubt that the lofty condition of the wool entering the carding machine is responsible for a large decrease in nep content of the sliver, but however lofty the wool is, there is always some nep formation in carding, and it has been considered desirable to study the effect of variations on the conditions of carding on the number of neps in the resulting sliver. For obvious reasons, most of the experiments were conducted on wool which was in the same condition as regards incipient felting, but two series were so large and extended over such a long period that it was considered better to scour the wool required for each experiment immediately prior to carding rather than to scour the whole lot at once.

#### Effect of neps on further processing

The presence of neps in a card sliver has an adverse effect on the tear in combing, the clearness of the top, and, consequently, the value of the top.

The tear, or ratio of combed sliver to noil, cannot be predicted solely from the number of neps in the card sliver, for there are other factors which probably have just as large a bearing on this ratio, not least being the extent of fibre breakage incurred during carding. As shown in Table III, however, the data obtained from five different experiments demonstrate that there is an inverse relationship between the number of neps in a card sliver and the tear of the wool. There is no universal relationship between the number of neps and the tear for all the experiments because they were carried out under varying conditions. Consideration of the combing action clarifies the point, for it is surely evident that the neps will tend to crowd the spaces

between the finer pins of the Noble comb circles and prevent the easy movement of the fibres during the drawing off action. The more neps there are present, the more chances there are of crowding up these spaces, resulting in a breakage of fibres as the rollers pull them forward. The same effect will be brought about in the French comb, for the neps will prevent the pins of the segment fallers passing freely through the tuft presented to them so that the fibres which are in front of the neps will be subjected to extra drag by the faller pins which will again lead to extra breakage. The action of the top comb resembles the action in a Noble comb, for here again the fibres are pulled through a grating. From what has been said it is obvious that the size of the nep is important: the smaller it is, the finer must be the grating to prevent its escape into the top, but finer pinned circles will lead to greater fibre breakage during the drawing off motion, and large neps would, therefore, seem to be preferable to small ones. On the other hand, large neps will cause a greater obstruction to the flow of fibres. The size of the nep is governed largely by the setting of the workers to the two swifts of the standard Botany card; the tighter this setting is, the smaller will the neps be, no matter what setting has been adopted in the licker section.

Table III

Experiment	Neps per gram	Tear
1a	12	7.6 : 1
1b	179	5.4 : 1
2a	55	10.8 : 1
2b	257	5.8 : 1
2c	310	5.2 : 1
2d	422	3.4 : 1
3a	31	8.1 : 1
3b	50	6.8 : 1
4a	82	9.7 : 1
4b	177	6.8 : 1
4c	281	5.9 : 1
5a	178	7.2 : 1
5b	283	6.1 : 1
5c	538	5.3 : 1

It can also be demonstrated that a greater number of neps in the card sliver results in a greater number being left in the combed sliver and consequently in the top, since there will be more chances for them to slip through the comb pins. Their presence in a top will hinder the free flow of fibres during the drafting process and probably lead to irregularities in the yarn. They will also limit the spinning power of the wool by protruding from the surface of a fine yarn.

The chief difficulty in any series of experiments on nep estimation is the definition of what shall constitute a nep. It was therefore decided that any cluster of fibres which does not come apart on being pulled in a direction at right-angles to the length of the sliver shall be termed a nep. With this definition in mind, a number of commercial tops were obtained from reputable Bradford combers and examined. Table IV gives an estimate of the number of neps found in these tops. It might be contended that the figures obtained are high but this is due to the arbitrary definition of a nep, and they must be interpreted as such. These figures are given solely to indicate the standard adopted in examining the various slivers for neppiness.

Table IV

Quality of top	Neps per gram
60's	5
64's	8
64's	8
70's	9
70's	8

1 gram is equivalent to 3 inches of a 256 dram top.

#### EXPERIMENTAL

The work of Kraus has shown that the nep content of a card sliver is governed to some extent by the quality of the wool and its treatment prior to carding. These factors are, in practice, more or less constant since the quality cannot be altered and the wool must be scoured. The aim of these experiments has therefore been to investigate the effect of the different variables which might be encountered in the carding process. There appeared to be at least two aspects of this problem; firstly, the condition of the wool, which might vary as regards its water content and the amount of added oil, for example, and, secondly, the actual carding conditions, which might be altered as regards speeds and setting. It was thought that a series of experiments conducted on these two lines would enable one to obtain a clearer picture of the formation of neps.

#### PART I. EFFECT ON NEP FORMATION OF ALTERATIONS IN THE STATE OF THE WOOL FED TO THE CARD

##### Preliminary experiments

It was first necessary to determine how neps are distributed in a card sliver. There are two possible variants; they might vary along the sliver, that is, the first yard of sliver issuing from a card may differ in nep content from that leaving the machine at any later period, or the neps may vary across the width of sliver due to some mechanical action of the card.

Stenersen<sup>3</sup> observed that neppiness increased with carding time or, in other words, the neppiness increases along the sliver, but the throughput in his case was very low, namely, 20 lbs. per hour.

It was decided to carry out this preliminary investigation in a worsted card room, so that sampling might extend over a longer period than would be possible on an experimental plant.

A machine was cleaned and run on with a blend of 60 per cent. 64's Australian and 40 per cent. 64's Cape wool. Samples of the sliver were taken throughout the running period up to the time when the card was considered to require cleaning. This test extended over a period of 45 hours. Samples of 2 yard lengths were taken periodically and from these, lengths of 1 foot were cut at 3 feet intervals and examined for nep content. At the same time as the sample lengths were being taken from the machine, the left-hand side of the sliver was marked so that it could be identified later. During examination, the 1 foot lengths were split down the centre so that it was possible to estimate the neps in the left and right hand halves of the sliver, and by summing the two a measure of total neppiness in the foot was obtained. This method of testing enabled one to study neppiness throughout the length of the sliver, across it, and at known intervals along the length. The results showing the deviations across the machine are shown in Table V, whilst their totals are graphed against carding time in Fig. II.

Table V

Sampling time (hours)	Neps per gram	
	Right side	Left side
$\frac{1}{4}$	12	13
1	13	12
$2\frac{1}{4}$	16	21
$3\frac{1}{4}$	20	15
$4\frac{1}{4}$	10	15
$5\frac{1}{4}$	16	11
19 $\frac{1}{2}$	17	18
$21\frac{1}{4}$	18	20
$23\frac{1}{4}$	17	21
$25\frac{1}{4}$	19	15
$27\frac{1}{2}$	13	15
$29\frac{1}{2}$	19	13
$42\frac{3}{4}$	30	22
45	23	18

The results show that there is no material difference in neppiness across the sliver as it leaves the card. Out of fourteen pairs of results, the left-hand side is more neppy in seven cases, and the right-hand side also more neppy in seven cases. The figures for the 1 foot lengths taken from the same portion of sliver were quite consistent, so that in future work a series of nine 1 foot lengths of sliver was examined for each experiment.

Taking the series of totals there is a slight tendency for the number of neps to increase with carding time, e.g., the averages of the first and last 3 hours' running are 30 and 46, respectively. There does not appear to be any great increase in neps over a period of time extending up to 20 hours' continuous running, and when it is remembered that this machine was carding 55 lbs. per hour it will be seen that there is no need to take account of carding time in a series of small experiments. Nevertheless, the nine samples required for nep estimation were always spaced over the entire test.

Before discussing the various experiments it will facilitate explanation if a general description of the experimental technique is given.

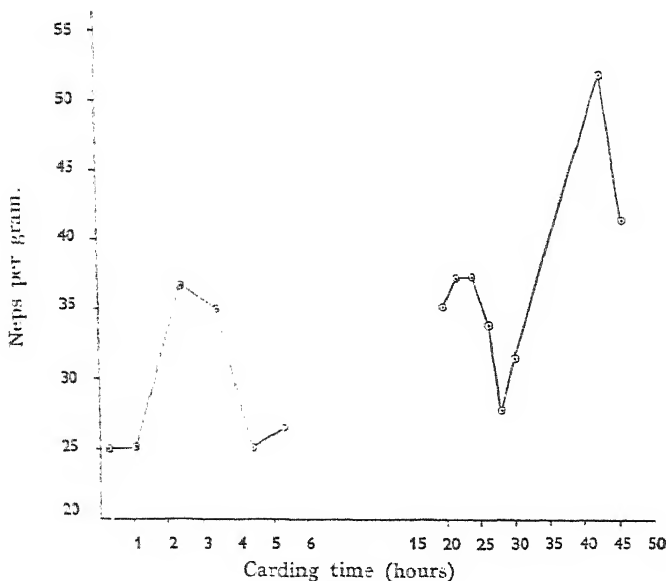


Fig. 2

The various wool lots were scoured by means of a swing harrow machine using soda ash and soap as the cleansing agents unless otherwise stated. Any drying of the wool was carried out in a machine using hot air. Additions such as oil and fat were dissolved or emulsified in suitable solvents and sprayed onto the scoured wool by means of a hand spray. The carding was performed on a half width botany type of machine, consisting of four lickers and two swifts, and unless otherwise stated the swift speed was 120 r.p.m. During the carding process, samples of wool were caught as they dropped into the hopper scale pan and samples of the sliver were taken at intervals throughout each test; these were used to determine the moisture content of feed wool and sliver. Again, the weight of sliver delivered by the back doffer was ascertained for several one minute periods, and the throughput per hour calculated from these weights as for a full-width machine. Three further samples of sliver, some 20 yards long, were also retained for nep examination, three counts being made from each length, so that each figure quoted for neppiness is the average of nine determinations. In each case the nep content is based on the dry weight of the wool. Where the various lots were combed for tear they were passed twice through an inter-sector gill box, 4 ends up, 4 of a draft, and then processed on a French comb. The setting of the latter remained constant throughout the tests.

#### Effect of wool grease

The first series of experiments was devised to observe the effect of wool grease on nep formation. 60 lbs. of 64's Australian wool were scoured, using Lissapol C paste and sodium carbonate. This wool was divided into equal lots and sprayed with a solution of anhydrous lanoline in carbon tetrachloride. The amount of grease added to the blends was 0, 0.4, 0.8, 1.2, 1.6, and 2.0 per cent. on the dry weight of the wool, the first lot being intended as a control. Each greasy lot was carded damp in ascending order of grease content, the machine having previously been stripped. The moisture content of the wool was approximately 34 per cent. regain and the throughput 15 lbs. per hour. Samples of the card slivers from the various lots were examined for nep content. These are shown plotted against the additions of wool grease in Fig. 3. The ether and alcohol extracts of the control card sliver were 0.38 per cent. and 1.04 per cent., respectively.

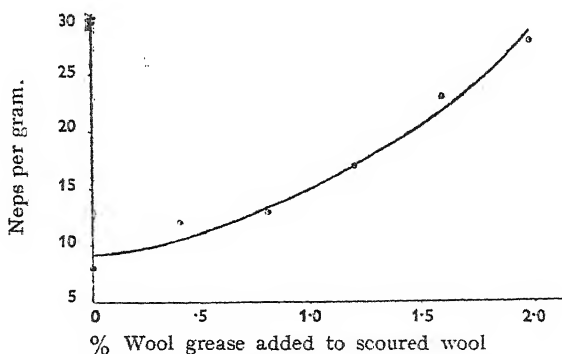


Fig. 3

It will be seen that there is a steady increase in neppiness with increasing grease content. An addition of 1.2 per cent. grease doubles the nep content of the original wool, whilst 2.0 per cent. grease trebles this amount, despite the fact that the throughput was very low.

A higher throughput would probably have increased the nep content still further.

**Effect of soap**

The next series of experiments was carried out to determine the effect on neppiness of the soap content of the wool. 70 lbs. of the same blend were scoured with the Lissapol C scour and the clean wool sprayed with varying amounts of soap solution, equivalent to 0, 0.25, 0.5, 0.75, 1.0 and 1.5 per cent. on the dry weight of the wool. The ether and alcohol extracts from the control sliver were 0.29 per cent. and 0.94 per cent., respectively. Carding was carried out on the same machine which had again been stripped. The regain of the wool was 46 per cent., the throughput was 26 lbs. per hour, and the number of neps per gram in the various slivers is shown as a function of the amount of added soap in Fig. 4.

The graph suggests that increasing soap content first leads to a decrease in nep formation and then causes a steady increase.

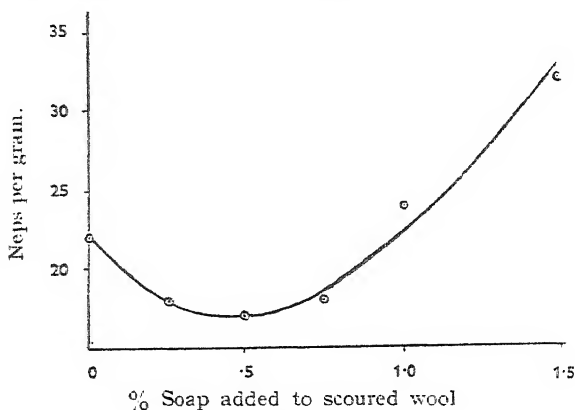


Fig. 4

**Effect of grease and soap**

A final series of experiments was made, using the same wool and scour, but this time both wool grease and soap were added to the clean wool. Four blends were carded:—the first contained no addition of soap or grease; the second 0.5 per cent. grease and 1.5 per cent. soap; the third 1.0 per cent. of each, and the fourth 0.5 per cent. soap and 1.5 per cent. grease, so that the total of added impurities was the same amount in each case. The regain of the wool was approximately 37 per cent., the ether and alcohol extracts of the control card sliver were 0.24 per cent. and 0.99 per cent., respectively, whilst the throughput averaged 31 lbs. per hour. The results are shown in Fig. 5. It will be seen that the nep content in the control experiment was 17 per gm., and this increased in sympathy with the increasing grease content. It is interesting to observe the differences in neppiness of the slivers, each containing the same proportion of impurity, for it will be seen that the increase of grease content from 0.5 to 1.0 per cent. caused an increase of 12 neps per gm., but a further increase of 0.5 per cent. in grease content only caused a rise of 6 neps. This small rise is attributed to the fact that the 0.5 per cent. soap content is not acting so drastically as it did in the second experiment when 1.5 per cent. of it was present. The main conclusions from these three series are that increasing amounts of wool grease will cause an increase in the number of neps, whereas small amounts of soap do not act so drastically. This is probably due to the more adhesive nature of the former, but it is interesting to note that a soap content of more than, say, 0.75 per cent., will act in the same manner as wool grease. In fact, the slope of the curve is steeper above 1.0 per cent. in the case of the soap than in the case of the grease, but the results are not comparable because the throughput of the former was greater. These results surely emphasise the



importance of clean wool. If the fibres go to the machine containing an adhesive, the card wires are unable to disentangle them so easily, for it must be remembered that many fibres can lie between adjacent teeth on a card roller and especially so in the forepart of the machine where the clothing is comparatively coarse.

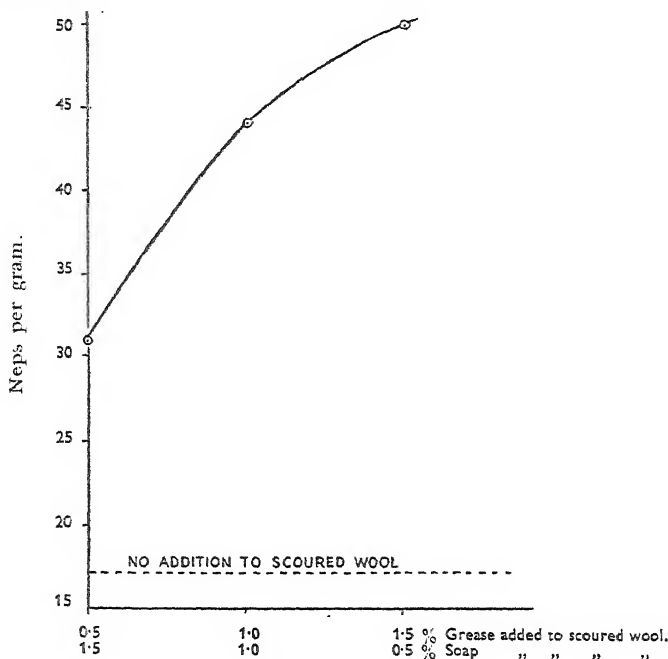


Fig. 5

#### Effect of burr

The third form of impurity found on wool is vegetable matter. It has been stated that the majority of neps contain no other nucleus except fibre, but some are found with a nucleus of vegetable matter. A further series, in collaboration with Mr. C. O. M. Steward, was therefore carried out to discover whether the presence of vegetable matter does lead to more neppy slivers. This large-scale experiment was made possible through the generosity of Messrs. W. & J. Whitehead, Ltd., of Laisterdyke, who loaned 1,000 lbs. of 64s clear Australian wool for the purpose. Nine 50 lb. lots of wool were scoured and carded with varying burr and moisture contents as set out in Table VI.

Table VI

Burr content of feed wool (%)	Moisture content of feed wool (% regain)	Neps per gram
1.30 3.41 11.79	19	185 ± 4 181 ± 3 184 ± 3
1.46 3.49 11.47	45	106 ± 2 115 ± 2 102 ± 2
1.06 3.49 10.61	54	106 ± 3 96 ± 2 108 ± 4

The results show the neps per gram in the various card slivers, together with the standard error, each figure being the average of nine determinations. A consideration of the data would appear to indicate that there is no relation between burr content of feed wool and the neppiness of the card sliver produced from that wool. It is however probable that burry wools may be neppier than those made from clear wools due to the action of the burr beaters on the wool as it passes beneath them.

Some explanation for the general increase in neppiness of these slivers as compared with those of previous experiments is clearly desirable. The chief difficulty in this series was that of procuring a natural wool which was uniformly burry. This is obviously impossible so that artificial means had to be used to produce one. Burrs were extracted chemically from some burry card waste, and these were then mixed with the scoured wool by passing the wool plus the required amount of burr through a teaser. This shaking action caused the wool to become more matted, and this led to a greater number of neps in the card sliver. Each lot of wool was, however, subjected to the same amount of shaking so that the results are comparative amongst themselves.

#### Effect of oil

Dickinson<sup>4</sup> carried out a series of experiments on the effect on nep content of varying the amount of added olive oil to a 64s wool. At 47 per cent. moisture content the neps per gram and fibre breakage of the card sliver were:—

Olive oil added to wool (%)	Neps per gram	Fibres below 65 m.m. (%)
0.0	61	61.9
0.5	60	57.7
1.0	67	50.0

Although the differences between the various slivers are small, they suggest that there is a critical oil content beyond which it is unwise to go if the neppiness of a carded web is to be at a minimum. It is interesting to note the beneficial effect of oil on fibre breakage.

Stenersen<sup>5</sup> compared the effect of various wool lubricants on the neppiness of merino card slivers and obtained the following results:—

Sample	Neps per gram
Unooled ...	31
1% Oleine ...	23
1% Olive oil ...	25
1% Mineral oil ...	30
1% Glycerine ...	27

In a further series of tests he showed that oleine does not produce so many neps as olive oil, although the trend of results obtained from the one oil was very similar to that with the other. For this reason, oleine was used as the lubricant in the following experiments.

100 lbs. of 64's Australian wool were scoured and the lot divided into five portions. The first was processed as a control lot, whilst the others were sprayed with a 50 per cent. emulsion of oleine in water so as to contain 0.5, 1.0, 2.0 and 8.0 per cent. of lubricant on the dry weight of wool. These lots were processed in the order of increasing amount of lubricant, and the slivers again examined for nep. The results shown in Table VII, together with the standard errors, indicate that there is a marked increase in nep

content when the lubricant exceeds 1 per cent., for it will be seen that an increase of a further 1 per cent. results in double the number of neps, whilst 8 per cent. oleine produced an exceptionally neppy sliver. The appearance of the wool on the workers during this experiment suggested that it was being rolled into a series of small pellets. It is interesting to note that these results conflict with Stenersens in that the unoiled wool had less neps than the oiled, whereas he found the reverse to be the case. The results are, however, comparable with those obtained in the wool grease series for there the untreated sliver had also the least number of neps. There is no doubt that wool containing more than 1 per cent. of oil will produce a more neppy sliver than that with less than 1 per cent. of lubricant.

Table VII

Oleine added to scoured wool (%)	Neps per gram (card sliver)
0.0	160 $\pm$ 6
0.5	178 $\pm$ 8
1.0	178 $\pm$ 8
2.0	283 $\pm$ 17
8.0	538 $\pm$ 78

Moisture content of feed wool = 43%

Throughput = 40 lbs. per hour.

The increase in nep content which accompanies the use of more than a certain amount of lubricant is attributed to the fact that this lubricant is acting as an adhesive and preventing the fibres from freely moving apart. Speakman and Greenwood<sup>5</sup> have shown that the force necessary to break a worsted roving oiled with various lubricants increases with an increase of oil and it is suggested that the same mechanism is acting in this case. If the addition of fairly small quantities of oil causes a large increase in the nep content of the sliver, one is obliged to ask why the product of the woollen card is comparatively free from this fault. An investigation was conducted to solve this problem and will be described in a later section. It must be remembered that the ratio of nep to fibre in a sliver is very small indeed, namely 1 : 230 by weight, so that it is quite possible to cause a large increase of nep by a small addition of any substance which has a tendency to produce that fault.

#### Effect of moisture

A further variable factor which might influence nep formation is the moisture content of the wool entering the card. A series of experiments was carried out by Lambert<sup>6</sup>, working in collaboration with Mr. C. O. M. Steward, the wool again being loaned by Messrs. W. & J. Whitehead, Ltd. This series utilised 1,000 lbs. of greasy 64s Australian matchings, each experiment being carried out with a 50 lb. lot. The object of the series was to determine the effect on neppiness of the moisture content of the wool fed to the card. Each lot of wool was scoured and dried where necessary, to varying moisture contents. Carding was performed on the same machine with the same throughput in each case. The results are shown in Fig. 6. Each observation is the average of nine nep determinations on the card slivers from each experiment. It is evident that dry wool produces more neps than damp wool, whilst there are least neps formed when the regain of the wool is between 30 to 50 per cent. The increase in nep formation at 70 per cent. regain is attributed to the fact that the wool was in a very wet condition and tended to adhere in the lock form.

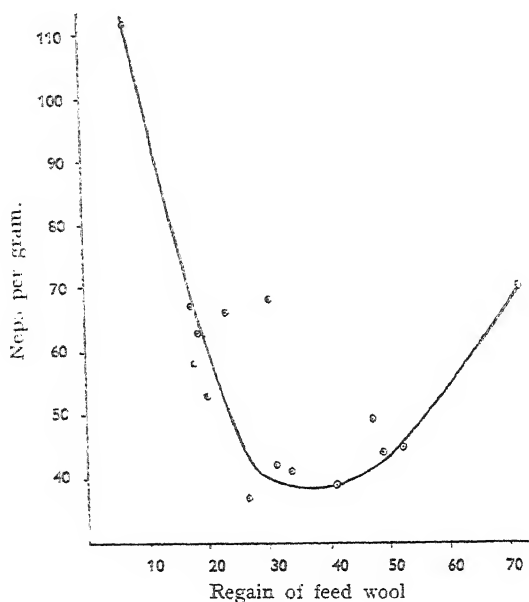


Fig. 6

The above results are confirmed by the data of Table VI, which have been rearranged in Table VIII to bring out the effect of moisture content on nep formation. It will be seen that each group of results shows the same tendency, namely, an increase in the moisture content of the feed wool is accompanied by a decrease in the nep content of sliver.

Table VIII

Neps per gram	Moisture content of feed wool (% regain)	Approximate burr content of feed wool (%)
155 ± 4	19.6	1
106 ± 2	41.2	
106 ± 3	51.0	
151 ± 3	13.8	3.5
115 ± 2	46.8	
96 ± 2	51.5	
184 ± 3	24.3	11
102 ± 2	48.3	
108 ± 4	59.0	

In presence of oil, too, the neppiness of the carded sliver decreases with increasing moisture content, as is shown by the results of Table IX. Here again the wet wool possesses less neps than the dry, whilst both the oiled wools are neppier than the unoled.

Table IX

Condition of wool fed to card	Neps per gram
40% moisture, no lubricant ...	95
40% moisture, 8% oleine ...	188
18% moisture, 8% oleine ...	232

Wool—64s Australian.  
Throughput = 39 lbs. per hour.

This decrease in nep content at higher moisture contents is accounted for by Speakman's observations on the elasticity of wool fibres and Stenersen's theory of nep formation. According to the former, the percentage extension of wool fibres before breaking increases with increasing moisture content; and according to the latter, most neps are formed during carding by the wool fibres being stretched and suddenly released, when, due to their elasticity, they coil up. If two card rollers act on such a coil, it will become entangled with the neighbouring fibres and form a nep. The extension and contraction, which play an important part in nep formation, occur whenever a wool entanglement is acted on by the card wires. Some of the fibres while being stretched are thus suddenly relaxed. If, however, the fibre is able to extend an additional fraction at this critical moment, it might avoid breakage and the consequent recoil. The percentage extension of wool fibres is greater at higher moisture contents, so there is less chance of them being broken in the disentanglement, particularly because the highest possible breaking load, which occurs when the wool fibres are absolutely dry, is negligible compared with the forces employed in a carding machine. Hence less neps are formed when wool is carded with a fairly high, as opposed to a low moisture content.

#### Effect of heat

Finally the card was heated by means of two steam cannons, in further work which was carried out in collaboration with Mr. C. O. M. Steward. The previous experiments on neppiness were repeated, using the same blend of wool, but this time the machine was heated. The results are given in Table X. There are nine pairs of comparable results, each pair being carded with more or less the same moisture content. It will be seen that where the moisture content of the feed wool is below 25 per cent., there is not a great difference between the nep contents of the steam-heated and ordinary slivers, although the "steam on" results are slightly better. When dealing with higher moisture contents, which have been shown to be essential for a reduction in nep content, the "steam off" series gives a better result in every case.

Table X

STEAM ON		Neps per gram	Neps per gram	STEAM OFF		Approximate burr content of feed wool (%)
Moisture content of feed wool (regain %)	sliver (regain %)			Moisture content of feed wool (regain %)	sliver (regain %)	
13.2	11.6	163 ± 3	185 ± 4	19.6	11.1	1
39.7	14.3	143 ± 8	106 ± 2	41.2	16.4	
48.0	17.5	125 ± 3	106 ± 3	51.0	18.2	
14.0	10.3	175 ± 6	181 ± 3	13.8	9.1	3.5
39.5	16.1	121 ± 5	115 ± 2	46.8	18.3	
48.5	16.1	122 ± 1	96 ± 2	51.5	19.2	
18.5	11.9	195 ± 4	184 ± 3	24.3	11.8	11
42.5	18.8	106 ± 2	102 ± 2	48.3	20.8	
65.0	20.8	126 ± 3	108 ± 4	59.0	23.3	

The effect of steam heating the front part of the card is to dry the wool during the carding operation. S. Townend<sup>7</sup> has shown that wool tends to leave the card at a regain dependent on the humidity and temperature of the atmosphere in the carding room, regardless of its original moisture content. If the forepart of the card is steam-heated, the greater part of the loss of moisture will take place between the feed sheet and first worker of the first swift, whereas without steam heating this reduction in moisture content is not so great at this stage and is more evenly distributed along the length of

the card. This retention of moisture allows the fibre to extend more easily and thus minimises the breakages which occur at lower moisture contents with a consequent reduction in the number of neps. The drying effect of the cannons is not so important when the wool is already in a dry state because there is then little loss of moisture during carding.

## PART II. EFFECT ON NEP FORMATION OF MECHANICAL ALTERATIONS TO THE WORSTED CARD

Having shown how the nep content of a sliver is varied by modifying the condition of the wool, further experiments were carried out to determine the effect of modifying the carding conditions.

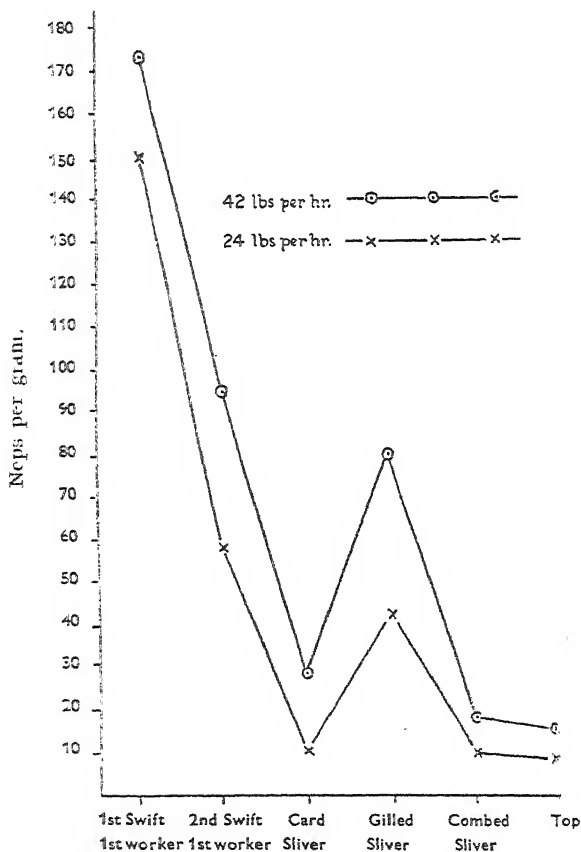


Fig. 7

It seemed necessary, first, to determine the location of neps in the machine. Two experiments were carried out, using 64s wool with a swift speed of 120 r.p.m. and throughputs of 24 and 42 lbs. per hour. Samples of wool were removed from the 1st workers on the 1st and 2nd swifts and the card sliver. Their nep content was then determined. Whilst it is recognised that the workers may be selective in action it is felt that since they are stripped at every revolution they will pick up the wool protruding from the swift face, whereas the swift is not entirely cleaned at each revolution, so that greater difficulties are entailed in sampling from this roller. The results of these experiments are shown in Fig. 7, which has several interesting features. In the first place, there is a gradual reduction in the number of neps as the material proceeds through the card; secondly, the larger throughput gives more neps; thirdly, the two curves are nearly parallel. It would appear

therefore, that, providing the machine is functioning in a normal manner, neps are formed by the time the wool reaches the 1st swift, and one of the functions of these two cylinders and their rollers is to comb out or reduce the number made in the licker section. Again, the thicker the stream of wool passing through the machine the greater will be the neppiness of the resulting sliver; this is no doubt due to the fact that there are more wool locks to disentangle, and the workers are only able to deal with a certain number.

Details of other tests carried out under varying conditions are given in Table XI. Each set of data was taken from a machine where the rollers were functioning in the normally accepted manner.

TABLE XI

Swift speed	Throughput	Neps per gram		
		1st Swift 1st Worker	2nd Swift 1st Worker	Sliver
80 r.p.m. ... ..	15 lbs. per hour	139	23	10
80 " " " " " "	31 " "	139	59	21
120 " " " " " "	55 " "	271	81	29
120 " " " " " "	50 " "	143	92	18
120 " " " " " "	50 " "	185	142	25

A further feature of Fig. 7, and one which throws a good deal of light on the problem of nep formation, is the continuation of the curves. The card slivers were passed twice through an intersector gill box, 4 ends up, 4 of a draft, combed on a French comb and again gilled twice on the same intersector, 4 ends up, 4 of a draft. The nep content was ascertained after each process.

The graph shows that the gilling operation following carding increases the number of neps. It is probable that this increase is due to the fibres in a card sliver not being arranged in a perfectly parallel order, although they tend to lie in that manner. When the high speed movement occurs at the front roller of a gill box the fibres lying in a crosswise direction will pull with them groups of other fibres and cause neps.

The combing process naturally reduces the number since the fibres are passed between very fine pins which prevent the neps going forward with the sliver, but the interesting feature is that there is no increase in neppiness when the same two gilling processes are repeated. There are two possible explanations of this fact: (a) the comb has removed most of the short fibres, or, (b) the fibres are now in a more parallel state. The first explanation is hardly feasible or the continental type of top would always be neppy. The second reason is suggested as being the correct one, namely, that the fibres, being parallel, are simply displaced by the drafting operation, and cannot form neps unless they pull other fibres forward with them, which is far less likely to occur in a set of parallel fibres.

This statement is substantiated by a series of experiments in which a 64s top was pulled up by hand and carded. The nep content of the sliver is shown in Table XII, and it will be seen that when the fibres enter the machine in an open state, so that they are easily disentangled by the various rollers, there is very much less chance of neps being formed, even when oil is applied.

It is now possible to refer back to Dickinson's work where an increase of nep content was accompanied by an increase in fibre length. Since the neps in the sliver are present by the time the wool reaches the first swift, it is suggested that the oil up to that time has acted as a lock lubricant rather than a fibre lubricant, its presence being restricted to small areas and is therefore more concentrated. This oil acts as an adhesive and helps to form neps. When the wool reaches the swifts, however, the fibres are being separated

and mixed so that the oil distribution is far more uniform and it now acts as a fibre lubricant and minimises breakage.

Table XII

Oleine added to top (%)	Moisture content of top fed to card (% regain)	Neps per gram (card sliver)
0.0	9.9	1.3
1.0	11.5	2.3
8.0	11.0	1.4
0.0	49.0	2.5
0.5	49.6	1.7
1.0	43.0	1.9
2.0	48.2	1.6
8.0	45.0	7.3

Average throughput of the "dry" series, 43 lbs. per hour.

Average throughput of the "wet" series, 37 lbs. per hour.

Neps per gram of top before carding, 4.5.

#### Effect of rate of production

The production of a machine may be affected in two ways: by altering the throughput, i.e., the thickness of the stream passing through the machine, or by altering the speed at which the stream moves, i.e., by altering the dimensions of the main drive to the machine. A series of experiments was devised to determine the part each plays in the formation of neps. The same blend of 64s Australian wool was used in each experiment. In the first place, the wool was carded at varying throughputs and a constant swift speed of 120 r.p.m. The machine pulleys were then changed to give a swift speed of 80 r.p.m., so that the speed of every roller was two-thirds of that used in the former experiment. Again, the wool was carded with varying throughputs. A summary of the results is given in Table XIII, illustrated in Fig. 8.

Table XIII

Swift speed r.p.m.	Nature of wool			Throughput (lbs./hour)	Neps per gram.
	Regain (%)	Ether extract (%)	Alcohol extract (%)		
120	34.5	0.67	0.62	15.0	14.4
				20.6	12.0
				26.4	14.5
				38.8	15.1
				46.8	19.2
120	41.9	0.44	0.89	19.6	11.6
				56.2	20.2
80	46.7	0.39	0.98	14.7	10.2
				31.0	20.5
80	47.3	1.76	1.02	15.0	11.9
				21.0	20.2
				23.0	30.6
				26.2	35.8
				33.6	62.0

It will be seen that with both swift speeds, increasing throughput results in a gradual increase in neppiness. The slopes of the curves for a slow swift speed are, however, steeper than those for the high speed. This is attributed to the fact that a machine is only capable of processing a certain thickness of material, beyond which the wires are unable to disentangle any more fibres. It will be evident that an increase in the speed of passing the same stream of



wool through the machine will enable a larger throughput to be obtained for the same degree of carding. If, therefore, the machine is taxed to its utmost by processing 56 lbs. per hour at a swift speed of 120 r.p.m., it is clear that when the speed is reduced to 80 r.p.m. the machine will be taxed to its utmost when the throughput is two-thirds that amount. In other words, 56 lbs. per hour at 120 r.p.m. is equivalent to carding 37 lbs. per hour at 80 r.p.m. An inspection of curves 2 and 3 shows that the same degree of neppiness is experienced by carding 56 lbs. of wool per hour at 120 r.p.m. and 30 lbs. per hour at 80 r.p.m.

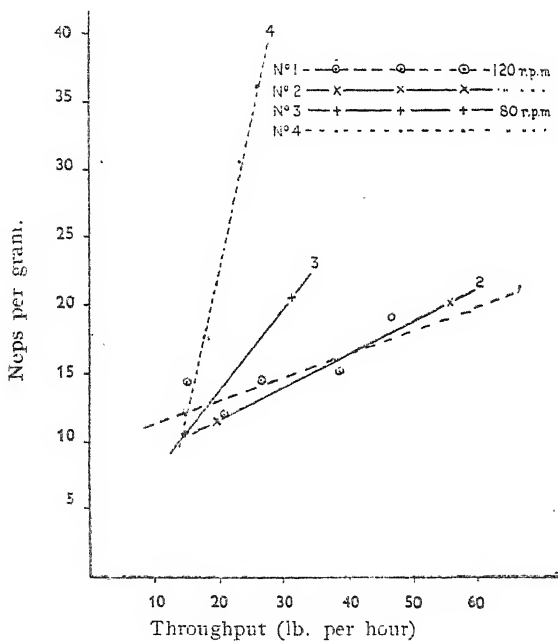


Fig. 8

Machine speed does not appear to have any effect on neppiness at low throughputs, for it will be seen that curves 2, 3 and 4 pass, very nearly, through the same point; namely, 10 neps per gram, at a throughput of 14 lbs. per hour. This is probably because the stream is so thin that the workers are able to deal more or less adequately with the material passing through the machine.

Curve No. 4 has been plotted purposely to stress once again the influence of grease and soap. The combined ether and alcohol extracts in the case of this wool amounted to 2.78 per cent., compared with 1.37 per cent. for No. 3. The shift over to the left, denoting increased neppiness, is attributed to the presence of unclean wool.

It therefore appears that an increase in throughput will result in increasing neppiness, using the same swift speed, but there will be less neppiness at the same high throughput when a high swift speed is employed, providing that the machine is not taxed beyond its capacity as a carding agent.

#### Effect of feed roller speed

The object of this series was to determine whether the rate of presentation of wool to the first licker-in affected nep formation. Eighty pounds of greasy merino wool were scoured for this test. The card was cleaned before starting each experiment. In the first experiment one-half of the available wool was carded with a fast feed roller speed (1.33 revolutions per minute), and in the second experiment the remainder was carded with the normal

speed (0.67 revolution per minute). The lick-in made 15 revolutions per minute in both cases, so that the relative surface speeds of lick-in and feed roller were 96 : 1 and 193 : 1, respectively. Samples of sliver were taken at intervals throughout the experiments. A summary of the results of neppiness is given in Table XIV.

Table XIV

Ratio, surface speed of licker to feed roller	Neps per gram	Moisture content of feed wool (% regain)
96 : 1	36 ± 2.6	25.4
193 : 1	43 ± 2.5	22.8

It will be seen that the fast feed roller speed produced a better result than the slow one, suggesting that a faster feed roller speed, or, since the speed of the lick-in remained unchanged, a smaller relative surface speed between feed roller and lick-in produces less neps. This is probably due to the fact that the carding action commences between the feed roller and the first lick-in, whilst the wool is still in its matted state. Hence a more gentle opening action at this point is less conducive to nep formation than when the maximum opening is affected at this part of the card.

#### Effect of setting

Kraus studied the effect which the setting of the various carding rollers on a Continental machine had on the amount of neps in the card sliver. The details are given in Table XV. It will be seen that the nep content of the sliver decreased as the workers were more closely set to the swifts. At the same time the fibre breakage, as indicated by the amount of noil, increased with the tighter settings.

Table XV

Setting	m.m.	m.m.	m.m.
Breast—1st worker ... ..	6.0	4.0	3.0
„ 2nd „ ... ..	5.0	3.0	2.5
1st Swift—1st worker... ..	5.0	3.0	2.5
1st „ 2nd „ ... ..	4.0	2.0	2.2
2nd „ 1st „ ... ..	3.0	1.8	1.2
2nd „ 2nd „ ... ..	2.5	1.0	0.6
2nd „ 3rd „ ... ..	2.4	0.6	0.5
2nd „ 4th „ ... ..	2.3	0.5	0.4
2nd „ 5th „ ... ..	2.2	0.5	0.4
2nd „ 6th „ ... ..	2.0	0.4	0.3
Neps ... ..	1240.0	840.0	590.0
Noils (%) ... ..	9.1	11.3	11.7
Fibres less than 40 m.m. (%) ...	28.8	31.8	31.8

There is no doubt that the setting of the rollers one to the other will influence the nep content of the sliver. If the machine is set open, that is, the rollers are set well apart from each other, then there will be more neps in the sliver, since the worker teeth will be less able to comb the clusters of fibres which go to make this particular fault. If, on the other hand, the rollers are closely set, the teeth will act on more fibres and less neps will result. This argument is confirmed by Kraus' work, but, as already stated, the Continental card differs from the British in that it does not possess the lick-in section. The setting of this section, whether open or close, is a debatable one, so it was decided to carry out an experiment, using both settings on the same 64's Australian wool. The lick-in section was set close for the one test and open for the second, but the swift settings remained unaltered. A summary of the results is given in Table XVI.

Table XVI

Setting of licker section	Throughput lbs. per hour	Neps per gram
Close	25	13
Open	24	11
Close	47	25
Open	42	28

In each case the test was performed at a low and a high throughput. The differences between the two pairs of results are not considered significant, and it is evident that any difference in nep content produced by a more open setting of the licker section can be nullified by a close setting on the swifts. Unfortunately, when this experiment was carried out, the disposition of neps along the card was unknown so that samples were not taken from the first worker on the first swift, but further tests are being performed to verify this conclusion.

#### Effect of dividers

The preceding work on the setting of rollers in the licker section led to further experiments in which the action of the divider rollers was studied.

The preliminary opening of the wool locks is performed in the British botany card by the licker-in section, each roller being clothed slightly finer and having an increased surface speed over the preceding one. This portion of the machine incorporates the divider and stretcher rollers. The card used has two top and two bottom dividers and also two stretcher rollers. Their object is to relieve the licker-in rollers of some of the wool, and by means of a working action to open the wool locks. This action is considered rather drastic.

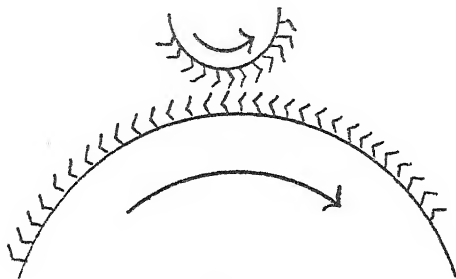


Fig. 9a

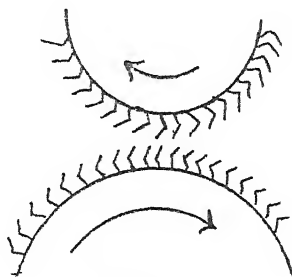


Fig. 9b

Two card rollers work the wool, if while acting on the fibres their teeth are moving "point to point." This is achieved with ordinary workers and swifts by the two rollers moving in the same direction at their point of contact, their pinning opposing each other as shown in Fig. 9a, and the swift having the greater surface speed. The working action can also be accomplished by two card rollers moving in opposite directions at their point of contact with their pinning opposing each other, as illustrated in Fig. 9b. This latter state exists between divider and licker-in, but instead of separating the wool gently, the divider tends to reverse the direction of the wool locks. Whilst a working action is attained in this manner, it must of necessity be a drastic one and was thought to be one source of nep formation. In the case of dividers this arrangement is inevitable (unless a special stripper is installed to clear each divider), because whereas the divider acts as a worker to one licker-in, the following licker-in acts as a stripper to the divider. The dividers, however, are not essential from the carding point of view, since each licker-in is stripped by the succeeding one.

The results of the feed roller series indicated that disentanglement of the wool locks should be accomplished in as gentle a manner as possible. It would therefore appear better to distribute this work throughout the entire card, rather than impose the major opening of the wool on the first few rollers. The present experiments were devised to test this theory.

A hundred pounds of greasy merino wool were scoured, yielding approximately 45 lbs. of clean wool. This was then divided into three equal portions. The first lot was carded with the machine running normally, the second without the two top dividers, and finally the remainder with all the dividers and the two stretcher rollers moved out of contact and inoperative. The "throughput" was maintained the same, and the card run off between each experiment. A summary of results is given in Table XVII.

Table XVII

NEPS PER GRAM		
Normal running	Top dividers out of contact	All dividers and stretchers out of contact
46 $\pm$ 1.7	39 $\pm$ 1.1	33 $\pm$ 1.1

Moisture content: feed wool, 31.4% regain.

These experiments demonstrate that divider rollers definitely increase the nep content of the sliver, for it will be observed that there is a decrease in the number of neps from 46 to 33, that is roughly 30 per cent., when these rollers are removed. This is probably due to the gentler carding action between the lick-in rollers when the drastic interference of the dividers is omitted. It would therefore seem an advantage, from the point of view of nep formation, to dispense with these rollers, but that would also bring about some disadvantages. The high throughput of the machine could not be maintained for any long period at the normal level, the card would need more frequent fettling and clearing, because the dust from the wool would not be so well removed in the first stages, and, most important of all, the present system of burr removal could not be used. One solution would be to employ a separate stripper roller to each divider, so that each one would make contact with one lick-in only, and reverse the direction of rotation of the divider. This would enable the same amount of disentanglement to be performed, but it would eliminate the reversal of the wool fibres and consequently reduce nep formation. Such a method would not allow the use of burr beaters on the dividers, so that they would either have to be placed to deburr the wool as it passed over the stripper as is done on the breast part of woollen cards, or, they might be placed over the lick-in after the divider, or some other method would need to be employed such as the Morel or a crushing device. At present, the latter can only operate on slivers. It appears to be a question of the relative advantages of less neppy slivers against the disadvantages of allowing vegetable matter to pass forward into the finer card clothing of the swifts, that is, unless some other deburring mechanism can be evolved.

#### Comparison of slivers produced from a woollen and a worsted card

More light can be thrown on the action of the lick section by comparing the slivers produced from a woollen scribbler and a worsted card. It was hoped that this experiment would allow a comparison to be made between the British and Continental types of machine, since the latter approximates to the woollen card so far as the arrangement of rollers is concerned.

The two machines were run at the same swift speed, namely 80 r.p.m., and the setting of the rollers was as nearly alike as possible. The breast

of the woollen card was set with a 24's gauge, the 1st swift with 26's and second swift with 28's. In the case of the worsted machine the setting of the licker section was normal,\* the 1st swift a 26's and the 2nd swift 28's gauge.

Both machines were specially ground for the experiment so that the carding conditions were as similar as possible, and a 64s Australian wool was again used. The throughputs of the two machines were adjusted so that they were approximately the same. Each experiment was repeated with 5 per cent. of oleine added to the wool, with the object of comparing the effect of oil on the neppiness of the slivers from the two machines. A summary of the results is given in Table XVIII.

Table XVIII

Process	Throughput lbs. per hour	Neps per gram
Woollen ... ..	28	18 ± 1
Worsted ... ..	26	24 ± 1
Woollen, 5% oleine ...	23	28 ± 3
Worsted, 5% oleine ...	26	75 ± 13

Moisture content of feed wool, 52·0% regain.

The sliver from the woollen scribbler is less neppy in both instances, and in the oiled experiment is very much better than the one produced from the worsted card. This increase in nep content, in the case of the oiled wools, is ascribed to the combined action of the licker section and the presence of oil. This again strengthens the argument that oil may act first as an adhesive and later as a lubricant, for the wool is converted into the fibrous form very much sooner in the case of the woollen scribbler than the worsted card, due to the action of the workers placed over the breast cylinder of the former machine.

#### Effect of fancy speed

The trend of results has shown that nep formation is likely to occur when a rolling of the fibres is brought about. It was therefore decided to investigate the effect on the neppiness of the card sliver of varying the speed of the 1st swift fancy roller over as wide a range as possible.

100 lbs. of 64s greasy Australian wool were scoured and carded. The swift and its rollers were stripped after every experiment, the duration of each being 45 minutes. It was considered that such a period would allow the effect of any change to be seen.

The slivers were examined for nep content and the results are shown in Table XIX, whilst Fig. 10 shows the neps plotted against the ratio of the

* Setting of licker section of worsted card:—	Gauge
Feed rollers —1st licker ...	20
1st licker —2nd licker ...	20
2nd licker —3rd licker... ..	28
3rd licker —4th licker... ..	28
4th licker —1st swift ... ..	28
1st licker —1st divider ... ..	20
1st divider —2nd licker ... ..	20
2nd licker —2nd divider ... ..	20
2nd divider —3rd licker... ..	20
3rd licker —3rd divider ... ..	24
3rd divider —4th licker... ..	24
4th licker —4th divider ... ..	28
4th divider —1st swift ... ..	28
1st licker —1st stretcher ... ..	20
1st stretcher—2nd licker ... ..	20
3rd licker —2nd stretcher ... ..	28
2nd stretcher—4th licker... ..	28

surface speeds of fancy and swift. It will be seen that there is a great increase in neppiness as the surface speed of the fancy approximates to that of the swift. There is a minimum value at a certain ratio, but it again increases when this is passed.

Table XIX

Revs. per min. of 1st swift fancy	Ratio surface speed of fancy to swift	Weight of material removed from swift and rollers (drams)	Neps per gram
454	1.34 : 1	129	72 $\pm$ 3
440	1.30 : 1	—	55 $\pm$ 3
383	1.14 : 1	218	257 $\pm$ 8
366	1.08 : 1	253	310 $\pm$ 8
345	1.02 : 1	254	422 $\pm$ 18

Swift speed, 118 r.p.m.

Throughput, 23 lbs. per hour.

The build up in neppiness with a decrease in the relative surface speeds of the two rollers is due to the fact that the fancy is no longer acting as an efficient clearing agent, i.e., it is unable to raise the material to the surface of the swift teeth for removal by the doffer, and so these gradually fill up as more material comes forward. Less effective combing of the wool between swift and worker is the result. In other words, the stream of material is so thick that the rollers are unable to cope with it, and a rolling of the wool occurs between the swift and workers. This statement is borne out by comparing the weights of wool removed from the swift and its accompanying rollers.

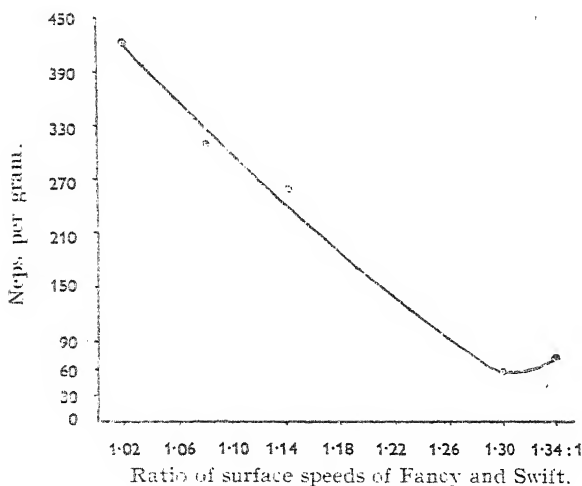


Fig. 10

The increase in neppiness with a speed ratio greater than the critical one is quite feasible, for above a certain swift-fancy ratio the teeth of the latter roller will raise the material so violently that it will be passed round the fancy and again be presented to the raising action; so that an overcrowding and rolling of the wool takes place at this point and an increased nep content will result.

It is not suggested that an optimum ratio of 1.3 : 1 for fancy-swift speed ratio is valid in all cases, but only for the particular card under consideration. This optimum speed ratio depends on many factors, e.g., depth of setting of fancy wire into swift teeth, flexibility of fancy and swift teeth, population of each roller, throughput of the machine, type of wool being processed, all of which may vary. The results of this particular experiment have,

however, demonstrated that the swift-fancy speed ratio is fairly critical and any adjustment on either side of the optimum value will cause more neps to be formed.

#### Effect of grinding

The grinding operation is considered to be a necessary one in worsted card rooms. The importance attached to it is emphasised when it is realised that the grinding action must wear away the wire teeth of the rollers, but evidently this decrease in the life of the card clothing is thought to be less important than that the card should work in an unground state. It was therefore decided to investigate the effect of grinding on the neppiness of the card sliver.

Only 700 lbs. of wool had been processed on the half-width card since the last grinding so that the wire was in a fairly good condition before the experiment was carried out. Nevertheless 40 lbs. of 64's Australian wool were scoured and carded and samples taken for the usual testing routine. The machine was then ground throughout. 50 lbs. of the same lot were then scoured and carded, so that the only difference between the two experiments was the condition of the wire teeth. The two slivers were compared for neppiness and a summary of the results is given in Table XX.

Table XX

Before grinding		After grinding	
Moisture content of feed wool (% regain)	Neps per gram	Moisture content of feed wool (% regain)	Neps per gram
23	43 $\pm$ 2.5	26	22 $\pm$ 0.7

It will be seen that the nep content of the sliver produced after grinding is half that of the unground card. This statement emphasises the importance of maintaining the card wire in a sharp condition, for it must be remembered that the machine had only processed 700 lbs. of wool (1,400 lbs. full width) since the previous grinding. In mill practice 10,000-12,000 lbs. of wool are carded before the machine is re-ground.

#### SUMMARY

The purpose of this investigation was to discover the factors responsible for the formation of neps in worsted carding, and to define the best conditions for minimising neppiness. The experiments, which were carried out on 64's Merino wool, may be classified under two headings, viz., those concerned with the state of the wool fed to the card, and those concerned with mechanical alterations to the machine.

As regards experiments of the former type, it was found that the neppiness of the carded sliver is at a minimum when the regain of the feed wool lies between 30 and 50 per cent. Steam heating of the forepart of the card does not appear to influence nep content to any large extent; with wool containing this critical amount of water the sliver is slightly more neppy when steam heating is used, whereas with wool at lower regains neppiness is slightly reduced.

The most important cause of nep formation is undoubtedly the tangled nature of the scoured wool normally fed to the card, for when pulled-up tops are carded the sliver is practically free from neps. From this point of view it would undoubtedly be best to use the solvent system of scouring greasy wool, and so long as the emulsion scouring method continues to be used, every precaution must be taken to ensure that felting—even incipient felting—is avoided. The need for such precautions is emphasised by the fact that there is a steady decline in the neppiness of the wool as it proceeds from the

first swift to the final sliver in the standard British type of botany card. Whatever method of scouring is employed, however, the wool should be as clean as possible, because it has been found that the neppiness of a carded sliver increases steadily with increasing grease content. In addition, if the amount of residual soap in the wool exceeds 0.5 per cent., the neppiness is accentuated, just as it is when the amount of added oil exceeds 1 per cent. The presence of burr in scoured wool is without influence on neppiness, except in so far as it necessitates the use of burr beaters, which promote nep formation.

As regards mechanical alterations to the machine, the nep content of the carded sliver decreases with increasing speed of the card as a whole, but an increase in throughput leads to a higher nep content. On the other hand, a reduction in the relative surface speed between feed rollers and first licker-in causes a reduction in neppiness. A further factor of importance is the setting of the workers to the swift; the closer these rollers are set to each other, the clearer is the sliver. Assuming a constant worker-swift setting, however, any alteration to the setting of the licker section is not reflected in the nep content of the sliver.

The action of the dividers, in reversing the direction of the wool at the divider-licker point of contact, is responsible for a fair proportion of neps, and the ratio of the surface speeds of fancy and swift is highly critical. If the fancy runs at a surface speed higher or lower than the critical value, there is a large increase in the nep content of the sliver. As would be expected, too, grinding has a great influence on neppiness; a newly ground card reduced the nep content to half the number present in a sliver produced immediately before grinding.

#### ACKNOWLEDGEMENT

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## TRANSACTIONS

### 4—ON THE EXISTENCE OF A CRITICAL TEMPERATURE FOR MILLING

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Harrison's discovery<sup>1</sup> that the rate of shrinkage of wool fabrics in a milling machine is most rapid at a temperature of 46° to 49° C., when soap is used as the milling agent, was afterwards confirmed<sup>2</sup> by experiments carried out in this laboratory, except that a slightly lower value of 45° C. was obtained for the critical temperature. The validity of these observations has since been questioned by Mercer,<sup>3</sup> who used the method of Creely and LeCompte<sup>4</sup> to determine the shrinkage of 1-metre lengths of 3-ply yarn in buffer solutions at pH values ranging from 4.0 to 11.0 and different temperatures.

According to the theory<sup>2</sup> which was advanced in 1933, the shrinkage of wool fabrics in a milling machine is due to the peculiar mode of migration of the component fibres. Because of their surface scale structure, the fibres tend to migrate in the direction of the root end under the repeated application of pressure, but free migration is impossible in a fabric owing to the restraints imposed by twist in the yarns and their interlacings with one another. Migration is achieved by local extension and contraction of the fibres, and milling shrinkage is promoted by conditions which favour these processes. It is well known that the resistance of wool fibres to extension in water decreases with rise of temperature up to 100° C., but their power of recovery, relative to their resistance to extension, decreases sharply at temperatures above about 35° C., presumably owing to disulphide bond hydrolysis. The precise temperature at which the increasing ease of extension is overwhelmed by a decreasing power of contraction should, of course, depend on the pH of the milling agent and the mechanical conditions of milling, since the reactivity of the disulphide bond in wool is greatly affected by the pH of the environment and the strains induced by fibre extension. Except under conditions where the disulphide bond is stable, there should be an optimum temperature for milling, provided that fibre movement is so restricted that it must occur by alternate extension and contraction of the fibres. Such restraint is normally present in woven fabrics, but was certainly not present in the yarn employed in Mercer's experiments, for he obtained shrinkages as high as 20 per cent. at 20° C. and 45 per cent. at 60° C. by mere shaking for 6 minutes in a buffer solution at pH 9.2. Mercer's

experiments could not, therefore, be expected to provide any evidence for or against the existence of a critical temperature for the milling of fabrics in soap solution.

As regards acid milling, the only evidence for an optimum temperature is the unpublished work of Harrison<sup>1</sup>, which has been called into question by Schofield<sup>2</sup>. It was thought desirable, therefore, to re-examine the effect of temperature variations on the rate of shrinkage of wool fabrics in acid, as well as alkaline media. The work was carried out with the aid of a model milling machine so as to realise more precise control over experimental conditions than is possible in large-scale work.

#### EXPERIMENTAL.

The apparatus used throughout the investigation was a stainless steel model of the Kilburn rotary milling machine, which was built to economise in fabric as well as for the sake of extra precision in experimental work. A cross-section through the machine, which is 5" wide, 14 $\frac{1}{2}$ " long and 13 $\frac{1}{4}$ " high, is shown in Fig. 1. The main rollers *A* and *B* each weigh 2.6 kg. and

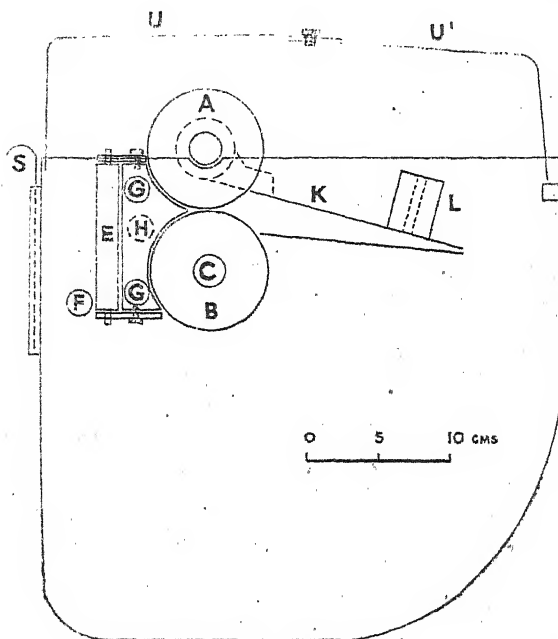


Fig. 1

are 3" wide and 3" diameter. In order to give adequate grip on the cloth during milling, the surface of each roller is scratch fluted, and the bottom roller *B*, which is mounted on the main shaft *C*, is driven by a  $\frac{1}{4}$  H.P. electric motor *Z*, running at 1,425 r.p.m., through an 11 : 1 worm reduction unit *Q* and a chain drive, as shown in Fig. 2. The main shaft *C* runs at a calculated speed of 129.5 r.p.m., which was found to be maintained in practice, and the surface speed of the bottom roller was thus 102 feet per minute. The top roller runs at the same speed as the bottom roller, and is driven from the main shaft *C* by means of a chain drive situated on the side of the machine away from the motor. Pressure is applied to the rollers by means of the compression springs *W*, which are held in position by the screws *Y*. The latter can, of course, be adjusted to vary the pressure on the cloth, which is introduced into the machine through the sliding door *S*. After passing

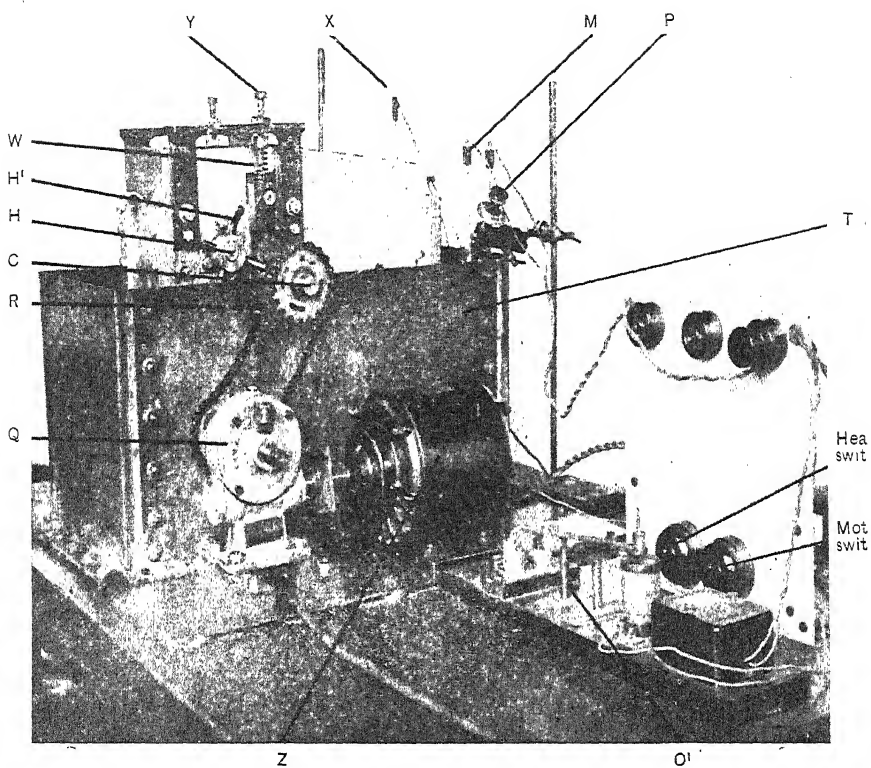


Fig. 2

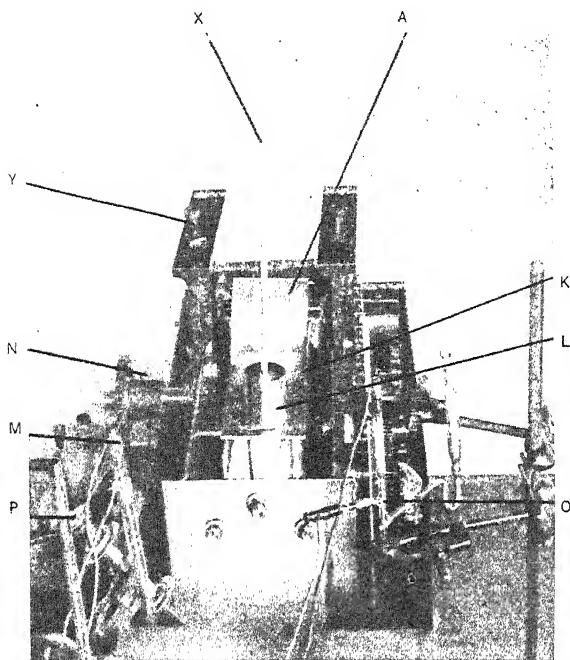


Fig. 3

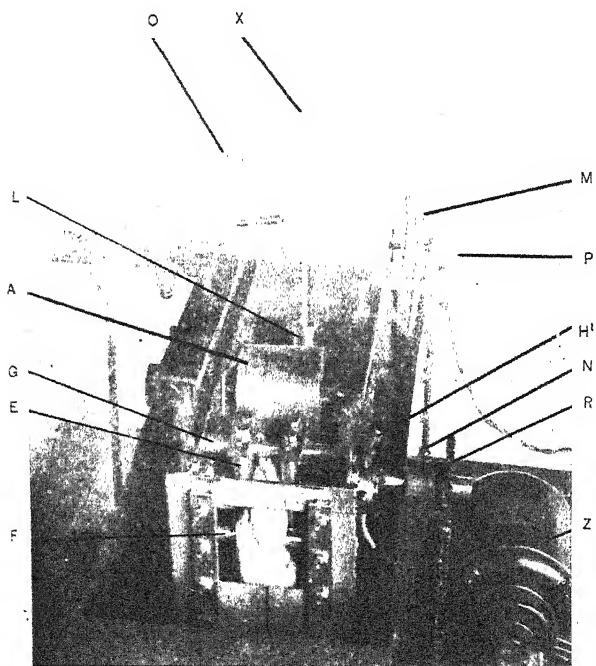


Fig. 4

through the rollers, the cloth enters the spout, which is provided with a hinged lid, permanently weighted, as shown in Fig. 3, with the stainless steel cylinder *L*. Through the latter is drilled an axial hole,  $\frac{3}{8}$ " in diameter, which reaches almost to the inner face of the hinged lid, for the purpose of accommodating a thermometer *X* to record the temperature of the cloth during milling. Despite its simplicity, this device was found to give accurate values for the temperature of the cloth, far more accurate than could be obtained by stopping the machine and inserting a thermometer into the folds of the cloth in the spout. Width-ways compression of the cloth is effected by means of the vertical rollers *E*, which run freely in bearings carried by the horizontal shafts *G* and *G'*, as shown in Fig. 4. The distance apart of the vertical rollers can be adjusted by turning the hand wheels *H'* to operate the two worms *H* (11 turns per inch). Before entering the vertical rollers, the cloth passes over a freely-running guide roller *F*, but there is no draft board. In the event of serious resistance being encountered by the cloth during milling, tearing is prevented by the fact that the sleeve holding the toothed wheel *R*, through which the machine is driven, is attached to the shaft *C* by means of a screw *N*. The latter acts as a friction clutch and slips on the shaft whenever the cloth is not free to travel through the main rollers.

So that the temperature of the cloth can be adjusted to and controlled at different values, the milling machine is mounted by means of four brass brackets inside a water thermostat *T*, which is  $10\frac{1}{2}$ " wide, 22" long, and 11" high. When full up to the lower edge of the sliding door *S*, the tank contains about  $3\frac{1}{2}$  gallons of water, which is circulated by means of the stirrer *P*. Temperature control is maintained by the thermoregulator *O*, which operates the immersion heater *M*, having an output of 800 watts, through the relay *O'*. The upper part of the machine, outside the thermostat, is closed by two easily removable lids *U* and *U'*. The latter are clothed with felt to minimise heat losses and serve the additional purpose of reducing the amount of water lost by evaporation from the cloth during milling.

Preliminary experiments showed there was usually some difference between the temperature of the cloth and that of the thermostat, although the cloth temperature became steady after a few minutes' milling. The cloth used in this work was made from 64s merino noil and had the following characteristics:—

*Warp*: 28s Yorkshire skeins, with 10 turns/inch twist; 41 ends/inch.

*Weft*: 28s Yorkshire skeins, with 10 turns/inch twist; 36 picks/inch.

*Weave*: Plain. *Weight*: 7 ozs./square yard.

Lengths of cloth, measuring  $81" \times 15\frac{1}{2}"$  and weighing about 190 grams air-dry, were wetted out in water, centrifuged, and then milled with 120 ccs. of a 5 per cent. soap solution. Temperature readings were taken every 10 minutes during milling and the results are shown in Table I.

Table I

Temperature of thermostat (° C.)	Temperature (° C.) of Cloth after milling for			
	10	20	30	40 minutes.
24.5	25.0	26.3	26.3	26.3
32.2	28.5	30.5	31.5	31.5
39.5	35.0	35.2	35.2	35.2
45.0	38.0	39.2	39.3	39.3
55.2	44.5	45.0	45.2	45.2

Owing to the frictional heat developed in the spout, the temperature of the cloth is higher than that of the thermostat at low temperatures; whereas the opposite is the case at high temperatures, owing to the heat lost through

the upper part of the milling machine which is outside the water thermostat. Although the temperature of the cloth can in all cases be controlled and fixed by means of the water thermostat, the delay of 10 to 20 minutes in reaching temperature equilibrium would be serious in milling experiments which normally occupy no more than 40 minutes. To obviate this delay, the temperature of the exposed parts of the milling machine is raised by blowing steam into the apparatus, condensed water being removed with a dry duster immediately before the cloth to be milled is introduced into the machine. In this way, very precise control over the temperature of the cloth was realised in the following study of the effect of temperature on the rate of shrinkage of wool fabrics during milling.

The all-wool flannel used throughout the investigation was a commercial fabric with the following characteristics :—

*Warp* : 20s Yorkshire skeins with 14.5 turns/inch twist ; 34 ends/inch.

*Weft* : 20s Yorkshire skeins with 10.0 turns/inch twist ; 31 picks/inch.

*Weave* : Plain.      *Weight* : 4.2 ozs./square yard.

Alcohol-soluble matter, determined by Soxhlet extraction : 1.5 per cent. on the dry weight.

Three sets of experiments were carried out, using soap, borax and sulphuric acid, respectively, as the milling agents, and as there were slight differences of procedure in each of these cases, it is convenient to give them separate consideration.

#### (1) Soap Milling

The general procedure adopted in carrying out a milling experiment was as follows. A strip of cloth, 200 cms. long and 38 cms. wide, was cut off the main length of flannel and weighed. About 40 cms. away from the ends of the strip, two rectangles, each 30 cms. long and 20 cms. wide, were marked out with coloured cotton. The fabric was then immersed in 2.5 litres of water overnight, centrifuged for two minutes, and, after measuring the areas of the rectangles, re-weighed. In the meantime, the temperature of the thermostat was adjusted to give the desired temperature of milling, in accordance with the data of Table I, and the exposed parts of the machine were warmed up with steam as described above. As soon as condensed water had been removed, the cloth was introduced and the ends sewn together with strong sewing cotton. The machine was then started and 100 ccs. of a 5 per cent. soap solution, warmed up to the temperature of the experiment, were added gradually to the cloth as it passed over the guide roller. The soap used in making up the stock solution for milling was a potash soap which contained 30.2 per cent. of water and had been prepared by direct neutralisation of fatty acids with caustic potash. The fatty acids had an iodine value of 38.7, a setting point of 46.2° C., an apparent molecular weight of 275 and a palmitic/stearic ratio of 52 : 48. Milling was allowed to proceed for 30 minutes in the enclosed machine with the front rollers 4.2 cms. apart, and temperature readings were taken after 5, 10, 20 and 30 minutes. No exact definition of the pressure applied to the cloth by the spring-loaded horizontal rollers can be given, because it varied with the state of folding of each part of the cloth as it passed between the rollers. With cloth between the rollers, the springs were compressed, and since each had a sensitivity of 15.5 kg./cm., it is evident that a large, unknown, but standardized pressure (as between one experiment and another) was applied to the cloth during milling. Although the machine was totally enclosed, it was not air-tight, and there was some loss of water from the cloth by evaporation, especially at high temperatures. In the light of preliminary experiments, it was found possible to correct the loss by making two equal additions of water through the slit in the machine lid, which accommodates the thermometer, after

10 and 20 minutes' milling. At temperatures above 50° C., some difficulty was encountered in maintaining the desired temperature of the cloth, and a small jet of steam was therefore blown into the machine at intervals by raising the sliding door, care being taken that the steam did not impinge directly on the cloth. The condensed water arising from this process compensated partially for the water lost by evaporation, and the amounts of added water were therefore smaller than would otherwise have been necessary. At the end of the milling period, the cloth was removed from the machine and weighed in order to determine the extent of the gain or loss of water during milling. From the data given in Table II, it is evident that, except at very high temperatures, the devices adopted to compensate for loss of water by evaporation were very successful.

Table II

Temperature (° C.)	Weight of Cloth (g.)				Change in Weight during Milling (g.)	Additions during Milling		Percentage Shrinkage in		
	Air- dry	After Centri- fuging	After Soap- ing	After Mill- ing		Water (ccs)	Steam	Length	Width	Area
15.6	131	168	268	263	- 5	-	-	20.0	12.3	29.9
16.0	130	168	268	259	- 9	-	-	20.5	10.8	29.0
24.4	130	170	270	265	- 5	6	-	25.2	13.9	35.6
24.5	132	171	271	267	- 4	6	-	24.2	13.8	34.6
31.5	128	166	266	251	-15	10	-	30.5	22.6	46.2
34.9	132	169	269	265	- 4	16	-	29.6	22.9	45.7
38.5	133	170	270	260	-10	18	-	32.4	23.5	47.8
47.0	130	164	264	262	- 2	28	-	29.9	21.8	45.2
51.4	130	164	264	258	- 6	10	+	32.0	23.5	46.9
52.1	131	170	270	256	-14	-	+	30.4	21.4	45.5
56.3	132	171	271	256	-15	-	+	32.5	21.0	46.8
58.3	127	166	266	295	+19	-	+	34.2	21.0	48.2

As soon as the cloth had been weighed, the dimensions of the marked rectangles were re-measured, and the shrinkages calculated. The results are given in Table II, illustrated by Fig. 5, where the shrinkage-temperature

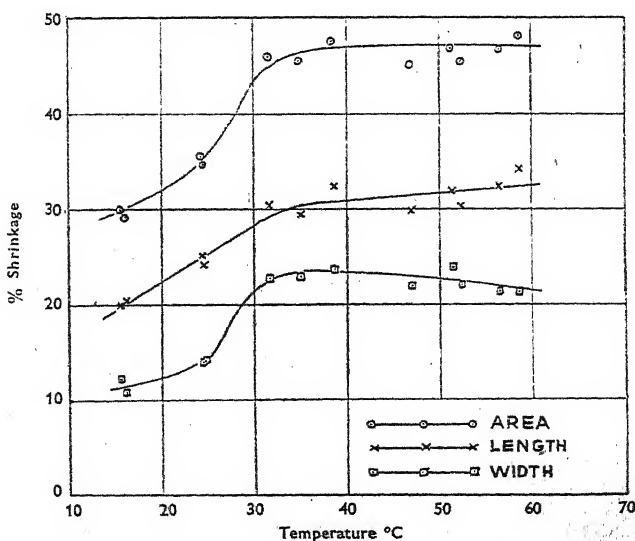


Fig. 5

curves show that the critical temperature for milling with the potash soap in the model milling machine is  $35^{\circ}\text{C}$ . At temperatures higher than this critical value, the width shrinkage decreases with rise of temperature and the area shrinkage remains approximately constant on account of the slight increase in length shrinkage. Length shrinkage is abnormally high in relation to width shrinkage because of the wide separation of the vertical rollers; when their distance apart is reduced to 2.5 cms., width shrinkage preponderates, but the wider separation of 4.2 cms. was used so that all experiments could be carried out under the same mechanical conditions, without the extent of shrinkage in acid milling being so great as to invalidate the results at high temperatures. Since the length shrinkage increases slightly with rise of temperature above  $35^{\circ}\text{C}$ ., the number of passages of the cloth through the machine and, therefore, the amount of work carried out on the cloth, must also increase with rise of temperature. In consequence, although the area shrinkage is almost constant at temperatures between  $35^{\circ}$  and  $58^{\circ}\text{C}$ ., the area shrinkage *for the same energy input* decreases with rise of temperature above  $35^{\circ}\text{C}$ . Even if this factor is neglected, however, the constancy of area shrinkage is sufficient to confirm earlier argument regarding the importance of the elastic properties of the wool fibre in relation to milling shrinkage. The ease of extension (deformation) of wool fibres in water increases steadily with rise of temperature up to at least  $100^{\circ}\text{C}$ ., and so should the rate of shrinkage if ease of deformation of wool fibres is essential for milling. Conversely, the power of recovery of deformed fibres, relative to the ease of deformation, first increases and then, above about  $35^{\circ}\text{C}$ ., decreases with rise of temperature in water.<sup>2</sup> If the shrinkage of wool fabrics is due to fibre migration by alternate extension and contraction, in the manner already described, there should be a critical temperature for milling at some temperature at and above which an increased ease of deformation is off-set by a reduced power of recovery from deformation. In the preceding series of experiments with potash soap as the milling agent, it is evident that a fairly exact balance between the two opposing factors is struck at temperatures between  $35^{\circ}$  and  $58^{\circ}\text{C}$ ., in accordance with the general theory of milling developed in a previous paper.<sup>2</sup>

In the earlier experiments which were carried out to confirm Harrison's discovery<sup>1</sup> of a critical temperature for soap milling, shrinkage was found to take place most rapidly at  $45^{\circ}\text{C}$ ., compared with the preceding value of  $35^{\circ}\text{C}$ . The discrepancy is no doubt due to differences between the large-scale and model milling machines. In particular, the mechanical action of the model milling machine is far more severe than that of the large scale machine, and in the large-scale experiments there was no precise compensation for water lost by evaporation during milling.

## (2) Alkali Milling

The physical properties of the soap solution used as milling agent in the preceding experiments must, of course, alter with change of temperature. In order to show that the critical temperature for milling is not determined by a change in the state of the soap solution, further experiments were carried out with a 2 per cent. solution of borax ( $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ ) as the milling agent. The general procedure was the same as in the preceding experiments, with the following exceptions. Each strip of cloth was soaked overnight in 2.5 litres of the borax solution instead of in water. After the cloth had been centrifuged, measured, and weighed, it was introduced into the machine and sufficient of the solution in which the cloth had been soaked (final pH 9.17) was added, after being warmed to the temperature of the experiment, to bring the total weight of the cloth up to twice its air-dry weight. The time of milling was 40 minutes and temperature readings were taken every ten minutes. Loss of water by evaporation was made good by adding three equal amounts after 10, 20 and 30 minutes'



milling. The results obtained in this series of experiments are given in Table III, illustrated by Fig. 6.

Table III

Temperature (° C.)	Weight of Cloth (g.)			Change in Weight during Milling	Additions during Milling		Percentage Shrinkage in		
	Air- dry	After Centri- fuging and adding Borax Solution	After Mill- ing		Water	Steam	Length	Width	Area
15.0	135	270	257	(g.) - 13	(ccs) —	—	17.9	9.4	25.4
23.0	131	262	253	- 9	5	—	22.1	12.6	33.2
26.8	135	270	263	- 7	8	—	24.2	16.7	37.0
34.7	135	270	265	- 5	12	—	27.5	21.6	43.4
38.3	138	276	266	- 10	15	—	28.4	23.8	45.2
41.7	129	258	246	- 12	18	—	29.2	20.7	43.8
43.8	132	264	260	- 4	27	—	28.5	18.8	41.8
45.3	131	262	255	- 7	27	—	29.4	19.4	43.1
47.7	132	264	256	- 8	27	—	28.8	21.0	44.5
55.3	129	258	250	- 8	3	+	31.7	20.7	45.6
57.6	137	274	273	- 1	24	+	30.7	19.1	43.7
60.8	138	276	313	+37	15	+	31.2	20.3	45.2

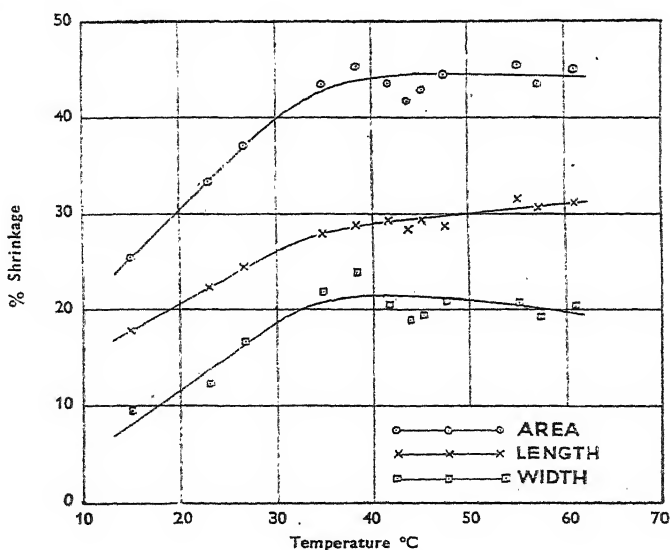


Fig. 6

In general form, the shrinkage curves are remarkably similar to those of Fig. 5 for soap milling, and the existence of a critical temperature for soap milling is clearly not determined by the properties of the soap used.

One peculiarity of the results obtained in soap milling and alkali milling is that the critical temperature (35° and 37° C., respectively) should be so close to the value of 35° C., the temperature above which wool fibres show increasing reluctance to recover from extension (deformation) in water. The fibres were not milled in water, however, but in alkaline media, and the most probable explanation of the difficulty is that the balance between an increasing ease of deformation and a decreasing power of recovery is struck at lower temperatures as the pH of the medium increases. This would, in fact, be expected from first principles because the power of recovery

of wool fibres from extension is governed to a large extent by the number of intact cross-linkages between the peptide chains, and the disulphide bonds are readily hydrolysed by alkali, especially when they are strained and the temperature is high. The hysteresis between extension and contraction of wool fibres in buffer solutions at various pH values was therefore determined at temperatures ranging from 25° to 65° C.

For this purpose, the root ends of Cotswold wool fibres, which had been purified by extraction with alcohol and ether in a Soxhlet apparatus, were attached by means of sealing wax or dental cement to light glass hooks in the usual manner. Each fibre, which was about 5 cms. long, was then immersed in the appropriate buffer solution for two hours at 22.2° C. before being stretched in another lot of the same buffer solution at the desired temperature. Extension was restricted to 30 per cent. and the fibres were taken through a cycle of extension and contraction by means of the Cambridge recording fibre extensometer, as modified to meet the requirements of this laboratory. The area of each hysteresis loop was calculated and expressed as a percentage of the area between the load-extension curve and the axis of extension. A summary of the results is given in Table IV, which includes the pH values of the buffer solutions at 22.2° C.

At pH 8 and above, the percentage hysteresis increases steadily with rise of temperature above 25° C., showing that in milling with soap or borax solution, there will be no difficulty in the reduced power of recovery from deformation compensating for the increased ease of deformation at 35° C. and above, as indicated by the preceding milling experiments. At

Table IV

Buffer	pH	Percentage Hysteresis at				
		25° C.	35° C.	45° C.	55° C.	65° C.
HCl + KCl ... ..	1.03	35.9	29.7	28.3	22.9	22.7
HCl + KCl ... ..	2.06	43.2	38.2	33.7	31.5	29.2
Na <sub>2</sub> HPO <sub>4</sub> + Citric Acid ...	3.10	50.8	44.6	43.5	38.6	37.7
" " " ...	4.12	55.2	48.0	47.5	43.7	44.6
" " " ...	5.08	57.7	50.4	51.6	47.8	50.7
" " " ...	5.87	57.5	52.3	53.7	54.1	64.1
" " " ...	7.00	58.0	55.4	65.4	72.6	77.5
" " " ...	8.10	58.7	63.8	75.4	86.1	88.3
Na <sub>2</sub> HPO <sub>4</sub> + KH <sub>2</sub> PO <sub>4</sub> ...	7.96	58.0	59.6	74.0	84.6	89.0
NaOH + H <sub>3</sub> BO <sub>3</sub> + NaCl ...	9.24	62.3	74.5	83.8	90.3	95.1
NaOH + H <sub>3</sub> BO <sub>3</sub> ...	9.98	69.0	80.8	91.3	93.7	98.4
NaOH + Na <sub>2</sub> HPO <sub>4</sub> ...	11.29	79.4	89.1	95.5	97.5	98.0
" " " ...	12.06	84.4	94.5	97.2	97.6	95.8
Glycine + NaOH + NaCl ...	12.83	73.5	85.8	84.9	83.8	88.4

pH 3 and below, however, the percentage hysteresis *decreases* steadily with rise of temperature above 25° C. and there seems to be no possibility of a critical temperature for milling in acid media. The only evidence that there is a critical temperature for acid milling is the unpublished work of Harrison, though some indication that it might exist is contained in Schofield's data for the felting of loose wool with acid<sup>6</sup>. Aral<sup>7</sup> attempted to confirm Harrison's results in 1939 by milling cloth with sulphuric acid in the Kilburn rotary milling machine at different temperatures. The cloth used was made from 64s merino noil, the 10 skeins yarn being woven in 2/2 twill weave with a setting of 22 ends and picks per inch. After the cloth had been scoured, it was dried in absence of tension and cut up into strips 32 yards long and 30 inches wide. Two areas measuring 36" × 20" were marked out in coloured cotton on each strip, which was weighed before immersion in cold water for 24 hours. The cloth was then centrifuged, weighed, and immersed in 10 times its weight of water to which concentrated

sulphuric acid had been added. The amount of sulphuric acid used was 4 per cent. on the air-dry weight of the wool and the pH value of the solution was measured before and after the cloth had been immersed for 24 hours at room temperature. After the cloth had been centrifuged and re-weighed, the areas of the rectangles were re-measured. The cloth was then fed into the milling machine and the ends sewn up, the temperature of the machine having previously been raised to the desired value by blowing in steam from a perforated pipe fitted underneath the floor board. In all experiments, the weight on the lid of the spout and the distance apart of the vertical rollers were kept constant, and the same volumes of the sulphuric acid solution with which the cloth had attained equilibrium during soaking were added as milling agent after the same times of milling. At regular intervals during each experiment, the temperature of the cloth was recorded by stopping the machine momentarily and inserting a thermometer into the folds of the cloth where it emerged from the spout. In addition, the machine was stopped at intervals of about 15 minutes so that the areas of the marked rectangles could be redetermined by making three measurements of length and four of width on each of the two areas. Shrinkages were expressed as percentages of the areas of the rectangles after the cloth had been immersed in the sulphuric acid solution, and the results are summarised in Table V, illustrated by Fig. 7.

Table V

Temperature (° C.)	Initial pH	Final pH	Time of Milling (minutes)	Percentage Shrinkage in Area
35.2	1.26	2.22	17	22.8
			36	44.3
			55	55.7
			72	60.6
			89	63.4
45.3	1.30	2.22	17	25.0
			34	45.5
			51	56.4
			68	62.0
			85	64.9
			102	67.0
54.3	1.28	2.29	17	26.6
			34	48.7
			45	56.6
			54	60.8
			71	65.1
			88	68.0
64.2	1.25	2.20	17	22.8
			34	42.7
			52	59.6
			69	65.6
			86	69.2
			103	71.6

It is evident that the critical temperature for acid milling is certainly not below 54.3° C., and although the curve for milling at 64.2° C. is below that for 54.3° C. up to 54 minutes' milling, the highest degree of shrinkage is ultimately obtained at the higher temperature. The results are remarkably precise for large-scale work of this kind, but no attempt was made to correct for loss of water by evaporation and it was feared that the results for high temperatures might be invalidated from this cause. Further experiments were therefore carried out in the model milling machine.

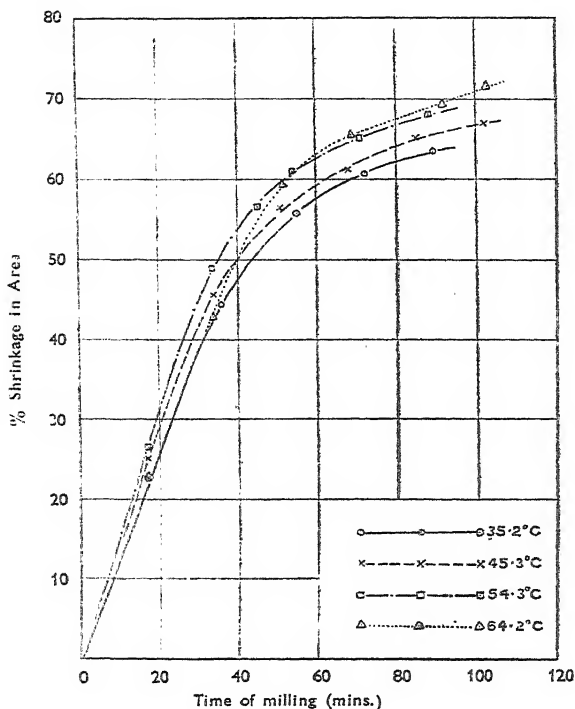


Fig. 7

## (3) Acid Milling

The general conditions of the experiments were similar to those adopted in the case of soap milling (p. 144). Each length of cloth was soaked overnight in 2.5 litres of a 0.4 per cent. (v/v) solution\* of sulphuric acid in water, centrifuged, measured, weighed and then introduced into the milling machine. After the ends of the cloth had been sewn up, the machine was started and sufficient of the solution in which the cloth had been soaked was added to bring the total weight of the cloth up to twice its air-dry weight. Milling was stopped after 30 minutes, and the results of the experiments are given in Table VI.

Table VI

Temperature (° C.)	Weight of Cloth (g.)				Change in Weight during Milling	Additions during Milling		Percentage Shrinkage in		
	Final pH	Air- dry	After Centrifuging and adding Acid Solution	After Mill- ing		Water	Steam	Length	Width	Area
					(g.)	(ccs.)				
17.2	1.34	142	284	270	- 14	—	—	27.4	16.0	39.0
19.1	1.36	132	264	249	- 15	—	—	29.6	18.4	42.4
24.6	1.32	133	266	260	- 6	6	—	34.0	23.1	49.3
29.0	1.31	129	258	251	- 7	8	—	40.8	29.3	58.1
34.7	1.30	132	264	260	- 4	14	—	39.2	33.2	59.4
39.5	1.28	134	268	267	- 1	20	—	40.2	36.8	62.0
42.0	1.33	130	260	251	- 9	20	—	42.2	34.8	62.2
46.8	1.30	133	266	266	0	26	—	42.7	41.4	66.4
58.0	1.33	130	260	258	+ 2	—	+	45.8	47.2	71.3

\* The large volume of solution, besides ensuring complete wetting-out, gave a final pH close to unity, where all salt linkages between the peptide chains of wool are broken.

From the shrinkage-temperature curves of Fig. 8, it is evident that, whether area-shrinkage, length-shrinkage or width-shrinkage is considered, the critical temperature for acid milling in the model milling machine is not below  $58^{\circ}\text{C}$ . This result is in conflict with Harrison's, but agrees with the theory of milling<sup>2</sup>, because the hysteresis between extension and contraction of wool fibres decreases steadily with rise of temperature in acid media.

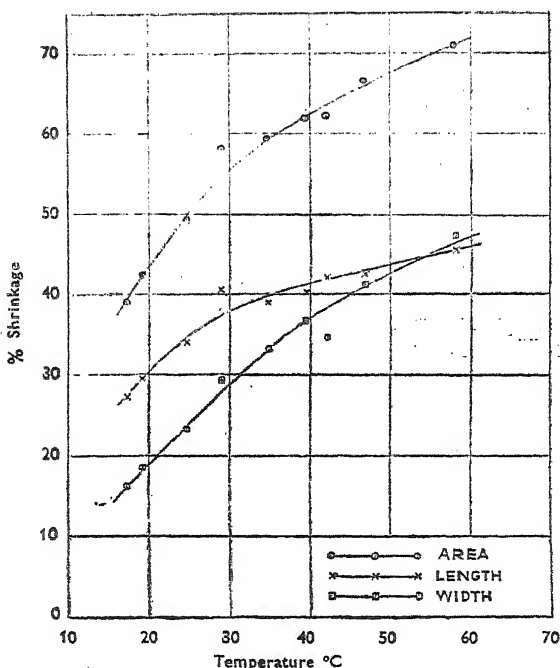


Fig. 8

### SUMMARY

Using solutions of soap, borax and sulphuric acid as milling agents, the rate of shrinkage of an all-wool woven fabric in a model milling machine has been determined at different temperatures up to  $60^{\circ}\text{C}$ . The optimum temperature for milling with solutions of soap and borax was found to be  $35^{\circ}$  to  $37^{\circ}\text{C}$ ., but no evidence could be obtained for the existence of a critical temperature for acid milling. These results lend further support to an earlier theory of milling<sup>2</sup>, for whereas the hysteresis between extension and contraction of wool fibres in alkaline media increases, the hysteresis in acid media decreases steadily with rise of temperature above  $25^{\circ}\text{C}$ .

The authors are indebted to the International Wool Publicity and Research Secretariat for grants in aid of the investigation.

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 5—FLUIDITY DETERMINATIONS ON FLAX CELLULOSE

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#### INTRODUCTION AND SUMMARY

Determination of the fluidity of solutions of cotton cellulose in cuprammonium hydroxide by the simple procedure standardised by Clibbens and his collaborators<sup>1, 2, 3</sup>, has become the principal method of estimating the amount of chemical degradation of cotton materials. It has the merit of sensitivity to slight amounts of degradation as well as giving fairly close co-ordination with tensile strength over a wide range of tendering. This agreement with tensile strength holds good for all types of chemical attack provided that the material is previously scoured in alkali in order to reveal the latent tendering induced by certain oxidising agents such as acid dichromate.

Application of the fluidity estimation to flax cellulose has been complicated by the fact that, even after thorough scouring, linen materials contain a small proportion of adhering lignified tissue and epidermis which is insoluble in cuprammonium. Working with medium-grade unbleached linen damask, Butterworth and Elkin<sup>4</sup> found that the insoluble matter amounted to 5.68 per cent., and that this could be reduced to 1.71 per cent. if the cloth was boiled in a 2 per cent. solution of sodium hydroxide before dissolution in cuprammonium. The presence of this insoluble portion might be considered objectionable from three aspects, namely:—

- (a) The correct concentration of cellulose in the solution is not attained.
- (b) The viscometer capillary is liable to become choked.
- (c) The presence of insoluble particles in the solution might affect the observed fluidity even if they were too small to choke the capillary or even if a falling sphere viscometer was used.

For these reasons it has so far been the practice to filter flax solutions before measuring the fluidity and, by weighing the insoluble portion, to apply a correction for cellulose concentration. The sensitivity of cuprammonium solutions to light and air necessitated filtration under an atmosphere of hydrogen and hence the whole estimation became considerably more involved than is the case with cotton. As a result the fluidity determination has not become the accepted routine method of measuring chemical degradation in linen and, instead, the cellulose solubility number described by Nodder<sup>5</sup> is in general use.

The cellulose solubility number involves rather more labour than the fluidity test as applied to cotton, but the apparatus is simple and the procedure is suitable for works use. It has the disadvantage of being insensitive during the initial stages of acid attack and an appreciable strength reduction can be produced without any accompanying increase in the cellulose solubility. Much better correlation with tensile strength is obtained in the

case of oxidative attack and hence its greatest value is for the detection of over-bleaching. However, there seems to be little doubt that for general purposes a fluidity measurement is to be preferred because of the good agreement with tensile strength for all types of chemical tendering and because of the sensitivity during the initial stages of cellulose degradation.

The present paper shows that the disadvantages associated with the insoluble matter in flax do not constitute an insuperable obstacle towards the development of a simple form of fluidity estimation. As far as the concentration correction is concerned, the material may be purified by a 6-hour boil in 2 per cent. sodium hydroxide solution and then assumed to contain, say, 2 per cent. of insoluble non-cellulosic matter. The small error involved in not actually determining the percentage of insoluble matter would be without practical significance, in the same way as it is sufficient to assume a moisture content of 6 per cent. when weighing cotton materials during the fluidity determination. A further justification of this procedure lies in the fact that in determining cellulose solubility it is permissible to assume constancy in the amount of non-cellulosic matter contained in the alkali-scoured material. Most bleached materials would contain even less than 2 per cent. of insoluble matter and the correction need not then be applied. The possible effect of undissolved particles in interfering with viscous flow must be considered, probably not so much on account of the danger of choking the capillary as by the possibility that in a swollen condition they might increase the apparent viscosity of the solution. This effect would be of greatest importance in the case of degraded samples where the viscosity of the cellulose itself is low. Assuming then that filtration is necessary, the problem of evolving a simple form of fluidity determination for flax resolves itself into one of simplifying the previous method of filtration. Filtration under an atmosphere of hydrogen, as described by Kinhead<sup>6</sup> has so far been considered necessary because earlier workers had found that exposure to light and air rapidly increased the fluidity of cellulose solutions in cuprammonium.

The use of a less sensitive solvent than cuprammonium would offer a possible solution to the problem and in this connection Russell and Hood<sup>7</sup> have shown that solutions of cellulose in a 2N aqueous solution of dimethyl dibenzyl ammonium hydroxide are much less sensitive to air and in the present paper this observation is confirmed and it is shown that, using this solvent in place of cuprammonium, flax cellulose solutions can be filtered in presence of air through glass wool in the same manner as the filtration is performed during determination of cellulose solubility number. If dimethyl dibenzyl ammonium hydroxide was less expensive and less tedious to prepare, it might prove to be suitable for routine fluidity measurements on linen but at present its employment seems to be out of the question. Accordingly, experiments were made to explore the possibility of stabilising cuprammonium solutions sufficiently to enable them to be filtered in presence of air without undergoing any significant change in the fluidity.

In the first instance it was established that any changes in fluidity likely to occur during short exposures to light and air, such as would be experienced during the operation of filtering, could for all practical purposes be regarded as due to degradation of the dissolved cellulose rather than to changes in the composition of the cuprammonium. Exposure tests and filtration tests were then carried out on cellulose solutions containing antioxidants and as a result it was shown that pyrogallol is very effective in reducing the sensitivity to light and air. Addition of 0.02 per cent. pyrogallol enables the cuprammonium solution of cellulose to be filtered in presence of air without appreciable change in the fluidity. It is therefore possible to suggest a simplified form of fluidity test for linen which, although slightly more involved than the procedure for cotton, is not any more complicated than the



cellulose solubility number. The material is boiled in 2 per cent. sodium hydroxide solution for six hours and then powdered finely and dissolved in standard cuprammonium in a stoppered test tube. The powder is assumed to contain 2 per cent. insoluble matter and 7 per cent. moisture, and the weight taken is such as to give a  $\frac{1}{2}$  per cent. solution of cellulose when the tube is completely filled with cuprammonium. After the cellulose is completely dissolved the requisite amount of pyrogallol, 4 per cent. of the fibre weight, is added and dissolved by shaking the tube for one hour. The solution is then filtered into a B.C.I.R.A. viscometer tube by gentle suction through a glass wool filter. For most purposes it is sufficiently accurate to add the pyrogallol by soaking the boiled and washed material in a 4 per cent. aqueous solution of pyrogallol for 15 minutes, and then air drying without further washing.

#### EXPERIMENTAL

##### Dimethyl-dibenzyl ammonium hydroxide

Previous investigators<sup>7, 8, 9, 10</sup>, who have studied the cellulose solvent properties of this quaternary base obtained supplies from the Rohm and Haas Co. of Philadelphia, but on enquiry it was learned that the manufacture has now been discontinued. Accordingly, for the present work a small quantity was prepared by the following method:—

A mixture of two molecular proportions of methyl iodide and one of dibenzylamine, the latter prepared from alcoholic ammonia and benzyl chloride, as described by Mason<sup>11</sup>, was dissolved in methyl alcohol and allowed to stand at room temperature for five days. At the end of this period the alcohol and any unreacted methyl iodide were distilled off and the residue treated with strong aqueous alkali to liberate unreacted dibenzylamine which was extracted with ether. The residue remaining was impure quaternary iodide and it was purified by re-crystallisation from alcohol and checked for melting point and iodine content. The yield was only 35 per cent. of theoretical but the recovered dibenzylamine, containing some methyl-dibenzylamine, could be reacted with a further amount of methyl iodide. The pure quaternary iodide (M.Pt. 191° C.) was shaken with an aqueous suspension of silver oxide at intervals for 48 hours and the mixture filtered through fritted glass and the precipitate washed with warm water. The filtrate was then concentrated to 2N strength by distillation on a water bath at 60° C. under reduced pressure. Using a 20 per cent. excess of silver oxide the yield of quaternary hydroxide was 75 per cent. of the theoretical amount obtainable from the iodide and this could be improved to 99 per cent. by using a larger excess of silver oxide.

The quaternary base prepared as above was a powerful solvent for cotton and flax and the resulting solutions were very much less affected by light and air than is the case with cuprammonium. Thus it was found that exposure of a 0.5 per cent. solution of grey cotton in cuprammonium for 15 minutes in a K.B.B. fugitometer caused the fluidity to increase from 1.9 to 30.0. With the same yarn dissolved in dimethyl dibenzyl ammonium hydroxide, a 6-hour exposure in the fugitometer was required in order to produce a similar proportional increase in fluidity. Ordinary exposure to air in diffused daylight for short periods had no appreciable effect and filtration could be accomplished without increasing the fluidity by more than 1 per cent. This agrees with the results of Russell and Hood<sup>7</sup>, who found that exposure to air for 3½ hours reduced the viscosity by only 4 per cent. There seems, then, to be no objection to the filtering of solutions of flax cellulose in the quaternary base, apart from the fact that the  $\frac{1}{2}$  per cent. solutions are extremely viscous when the cellulose is undegraded. When the cellulose concentration is reduced to  $\frac{1}{4}$  per cent., the solution can be filtered quite readily through glass wool and this strength was employed to compare the fluidities of the undernoted samples of flax yarn before and after filtering.



The extensive change in fluidity produced by exposure to the carbon arc is noteworthy and must be presumed due to the action of ultra-violet light rather than to development of heat in the solution because when a tube of undegraded cellulose solution was covered with a thin black cloth and then exposed in the fugitometer, the fluidity rose to only 2.5 after  $\frac{1}{4}$  hour. Confirmation was obtained by admitting air to another tube of undegraded cellulose solution and heating it in the dark at 30° C., the maximum temperature reached in the fugitometer, for  $\frac{1}{4}$  hour. The fluidity was found to be unaffected at 1.6. The fact that light causes a large increase in fluidity even without admission of air suggests either that the action of light is independent of the presence of air or that sufficient air is contained in solution. From the results recorded it seems that the solution of cellulose in standard cuprammonium is not particularly sensitive to air in the absence of light.

The increase in fluidity which occurs when the cellulose solution is exposed to light and air could be regarded as due to one or more of the following factors:—

- (a) degradation of the cellulose ;
- (b) changes in the cuprammonium itself affecting its solvent properties ;
- (c) changes in the cuprammonium itself affecting its own fluidity.

It can be readily demonstrated by examination of the regenerated cellulose, that extensive degradation of the cellulose does in fact take place when the solution is exposed to ultra-violet light. In one experiment air was admitted to a viscometer tube containing a solution of undegraded cellulose until the liquid level was  $\frac{1}{4}$  in. above the top mark. The tube was then inverted four times, placed in a vertical position just inside the ring of test spaces in a KBB fugitometer and exposed to the light for 15 minutes. At the end of this period the tube was removed, again inverted four times and allowed to cool in the dark for 30 minutes from approximately 30° C. to 20° C. The solution then had a fluidity of 30 and the regenerated cellulose from this solution gave the usual reactions of a degraded cellulose and, in addition, it had a fluidity of 36 when dissolved in fresh cuprammonium and the fluidity determined in the standard manner. In comparison it was found that the cellulose regenerated from an unexposed solution had a fluidity of only 3.5 when re-dissolved.

To determine the effect of factor (c), air was admitted to a tube containing cuprammonium itself, without dissolved cellulose, and it was found that exposure to the fugitometer for 15 minutes increased the fluidity from 70.8 to 73.5, which comparatively small change is of little importance.

Factor (b) is more likely to have an appreciable effect because it is well-known that changes in the composition of the cuprammonium can affect the cellulose fluidity, quite apart from the possibility of cellulose being precipitated from solution. To determine whether exposure to light and air caused such changes, solutions of undegraded cotton were made from ordinary cuprammonium and from cuprammonium which had previously been exposed. Comparative fluidity measurements were then made and the results are shown in Table III.

Table III

Method of exposure of solvent	Observed fluidity of undegraded cotton
Unexposed ... ..	1.6
Exposed 15 minutes in fugitometer ... ..	1.7
Shaken with air 4 hours in dark ... ..	2.1
„ „ „ 4 „ „ diffused daylight ... ..	2.1
Filtered twice at the pump ... ..	1.6



It is very clear that at and above 0.02 per cent. concentration the presence of pyrogallol enables the solution to receive fairly severe exposure to light and air without concomitant degradation of the dissolved cellulose. That this effect is not merely due to the pyrogallol increasing the viscosity and so masking any degradation is shown by the fact that in Table V the unexposed solution containing pyrogallol gives a normal fluidity. Fluidity tests were also carried out on unexposed solutions of a degraded cellulose, with and without pyrogallol, and the results were 26.6 and 26.1 respectively, thus confirming that pyrogallol has no tendency to lower the fluidity and that its effect during exposure of a solution must constitute protection of the cellulose against oxidation.

It is reasonable to expect that similar protection would be exerted in the case of flax cellulose and that the presence of pyrogallol would enable solutions of linen materials in standard cuprammonium to be filtered without risk of degradation. For confirmation, fluidity determinations were made on samples of  $8\frac{1}{2}$ 's lea flax tow yarn, dry spun, and the results are shown in Table VI. All samples were boiled for 6 hours in 2 per cent. sodium hydroxide solution and 0.02 per cent. of pyrogallol was added after the cellulose had dissolved. The fluidity was first measured without filtration and for most of the samples the same solution was then filtered and the fluidity again measured.

Table VI

Sample	Cellulose solubility number	Fluidity	
		Before filtering	After filtering
A —boiled ... ..	2.2	1.4	1.5
B — $\frac{1}{4}$ white ... ..	3.5	3.5	3.4
C1 —acid tendered ... ..	2.9	5.0	4.7
C2 — " " ... ..	3.9	7.3	—
C3 — " " ... ..	6.8	12.1	12.1
D1 —hypochlorite tendered ... ..	7.9	7.0	6.5
D2 — " " ... ..	9.5	11.9	—
D3 — " " ... ..	18.7	23.5	22.6

The close agreement between the fluidities before and after filtration is of great interest and confirms the effect of pyrogallol in inhibiting degradation of dissolved cellulose. Table VII shows that there is no loss of ammonia during filtration and hence there is no possibility of degradation being masked by a decreased fluidity caused by loss of ammonia.

Table VII

Solution	Ammonia content (grams per litre)	
	Unfiltered	Filtered through glass wool
Standard cuprammonium ... ..	191	190
Solution containing 0.5% cotton (fluidity 1.8) ... ..	191	188
Solution containing 0.5% cotton (fluidity 28.0) ... ..	191	193

It is evident that the cuprammonium fluidity of flax cellulose can be determined in a simple and reliable manner by scouring the material in 2 per cent. sodium hydroxide before powdering and by including 0.02 per cent. freshly added pyrogallol in the solution to prevent any change in fluidity of during filtration. For greatest accuracy the pyrogallol should be added after the cellulose is dissolved so that its weight is not included along with the weight of powdered material. However, for most purposes it would suffice to immerse boiled samples in a freshly made 4 per cent. solution of pyrogallol

for 15 minutes and then squeeze off excess and air dry at ordinary temperature without washing.

The powdered material should be dissolved in standard cuprammonium in a completely filled stoppered test tube, the volume of which has previously been accurately determined so that the weight of powder necessary to give a 0.5 per cent. solution may be ascertained. The powder may be assumed to contain 7 per cent. moisture, 2 per cent. insoluble matter and 4 per cent. pyrogallol while, if the material is fully bleached, the correction for insoluble matter could be omitted. The capacity of the tube should be approximately 25 c.c., and a small cylindrical piece of iron is added to mix the contents while the tube is being shaken overnight on a slowly revolving wheel.

The solution is filtered into a B.C.I.R.A. capillary viscometer through a glass wool or coarse fritted glass immersion filter attached to a glass tube leading through a rubber stopper inserted in the wide end of the viscometer and gentle suction applied by means of a vacuum pump connected to the capillary end of the viscometer. Using 0.5 gram of glass wool packed into a suitable tube so as to form a column 2 cms. long by 1 cm. in diameter, it was found that even the most viscous solutions can be filtered in five minutes under gentle suction. The addition of pyrogallol darkens the colour of the cuprammonium and it is rather difficult to observe the clarity of the filtered solutions but judging from the appearance of flax solutions not containing pyrogallol the insoluble matter is effectively removed by glass wool. After filtration the fluidity is determined in the manner standardised by Clibbens and co-workers (*loc. cit.*).

The fluidity method which has been outlined involves slightly more labour than the standard determination applied to cotton but it can be performed just as rapidly as the cellulose solubility number and involves no special apparatus apart from the calibrated viscometer tubes. Its chief practical advantage over the cellulose solubility number lies in the greater sensitivity during the initial stages of degradation while the ability to detect the early stages of acid tendering, clearly shown in Table VI, is of much practical importance in the investigation of faults.

As far as cotton is concerned the present standardised fluidity determination seems to be generally satisfactory although Berl<sup>12</sup> considers that the cuprammonium solution of cellulose is too sensitive to light and air and prefers to estimate the viscosity of the nitrocellulose in acetone. The use of pyrogallol with cotton solutions should be advantageous in special cases, for example, where there is a possibility that the ordinary daylight might be strong enough to cause degradation during the period of flow of the solution through the viscometer.

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 6—A GENERAL-PURPOSE PHOTOELECTRIC PHOTOMETER AND ITS USE IN TEXTILE LABORATORIES

By N. H. CHAMBERLAIN

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#### INTRODUCTION

During the course of research on textile projects, it frequently happens that long series of measurements are required of some physical property of textile fibres, yarns, or fabrics, such as fibre diameter or length, yarn regularity, fabric thickness, lustre, or weight; or it may be that research in colour chemistry necessitates repeated determinations of the concentration of dyestuff solutions, or the depth of shade attained by dyed patterns. In some cases the methods available for such determinations are simple and rapid, but in others, notably fibre diameter, yarn regularity, and the reflection colorimetry of dyed fabrics, this is not so. Long series of measurements of fibre diameter with a microscope are not only tedious and time-consuming, but throw a definite strain on the operator's eyes; further, particularly in the case of fine fibres, their accuracy leaves much to be desired, owing chiefly to the difficulty of defining the edge of a cylindrical object such as a fibre with a lens of high power. (The projection method, using fibre cross-sections, is not available if the fibres to be measured have to be preserved for further work, as is nearly always the case.)

It so happens that a large proportion of these physical properties are either dimensional in character, or optical, and there seems to be no good reason why the photoelectric cell should not replace the eye with benefit both to the operator and the accuracy of his results. Some attempts in this direction have already been made, notably by Barker and Stanbury<sup>1</sup>, who used this method for the determination of yarn regularity, McMahon<sup>2</sup> who determined the amount of kemp in fleece samples photoelectrically, and Cunliffe<sup>3</sup>, who has utilised a photoelectric cell in conjunction with a valve potentiometer for absorption colorimetry. In the two former cases it is doubtful whether the apparatus described possessed the necessary degree of robustness and fool-proofness for routine use in the hands of students and semi-skilled operators.

The present paper is an account of an attempt to produce a general-purpose photoelectric photometer capable of adaptation to the measurement of at least a few of the properties mentioned, together with some of the results obtained in its use.

#### The Criteria of an Ideal Apparatus

Before proceeding to a discussion of the actual apparatus, it may be well to summarise the properties and qualities that were aimed at. The degree to which these have been achieved can then be better assessed. First then, the apparatus should, if possible, be direct-reading. Null methods and compensation methods have undoubted advantages as regards absolute precision, but become tedious when long series of measurements have to be

made. Second, the final instrument upon which readings are taken must be robust, quick in action, and capable of withstanding reasonable overloads for short periods without damage and without altering its calibration. Moving-coil instruments of the pivoted type such as milliammeters, millivoltmeters, or voltmeters, answer this description, and have this additional advantage, which may be given as the third desirable attribute of the apparatus, that they may be used in full daylight and without any particular precautions against vibration, stray fields, etc., such as are often necessary when reflecting galvanometers, electrometers, and the like are employed. Fourth, if at all possible the whole apparatus should be mains-driven from A.C. mains, and the inconvenience of batteries, for either high- or low-tension supply, eliminated. Fifth, the apparatus must have a stable zero and a calibration which requires checking only at infrequent intervals. Sixth, straight-line relationships between the quantity measured and the instrument reading are very desirable, as simplifying calibration very considerably. Seventh, the random error of individual readings should not exceed 1 per cent. The impression gained from a study of the literature seems to be that this figure, while by no means the limit of accuracy to be obtained from photoelectric equipment under stringent conditions of control and with considerable experimental elaboration, represents just about what may be expected from careful design, a reasonable use of automatic control where possible, and commercial light sources and photocells. Most experimenters have condemned the use of the mains as a source of power if accuracy of this order is required, but the objection is largely bound up with the way in which the photocell is used, and full advantage has not been taken of the various automatic voltage- and current-controlling devices which are now commercially available.

#### General Considerations in Design

The principles of operation of photoelectric cells are too well known to require detailed description. Emission cells only are considered in the present connection, because this type gives the greatest precision in practice, and is the only type to which valve amplification can conveniently be applied. The emission photocell is essentially a current generator; the most sensitive type, the caesium-silver oxide gas-filled cell, gives a minimum of 75 microamperes per lumen of incident light, when the latter is that from a tungsten-filament electric lamp. Vacuum cells have sensitivities of approximately one-tenth this figure or less. Quantities of light of the order of one lumen, however, are rarely allowed to fall on the cell. In the present case, preliminary calculations confirmed by rough experiments showed that the amount of light which would be available at the cell cathode in most of the applications suggested earlier, would rarely exceed one millilumen, and might be only one-tenth of this, namely, 0.0001 lumen. The currents to be measured, to an accuracy of one per cent., will thus vary from about one-tenth to one-hundredth of a microampere. Whatever type of apparatus is used, therefore, it must be sensitive to at least  $10^{-10}$  ampere. Now, in practice, the photocell is always made to function as a generator of voltage rather than of current, by causing the photoelectric current to pass through a large external resistance termed the load resistance, and measuring the voltage drop across this resistance. In theory, since the cell itself has an extremely high internal resistance, the load resistance also can be made very great, and thus small photoelectric currents can be made to generate large voltages in it. Thus, in the present case, if a load resistance of 100 megohms is used, a current of 0.1 microampere will give a voltage drop of 10 volts across it. The only instrument capable of measuring this voltage directly, however, would be an electrometer such as the Lindemann or Compton instrument; for since the instrument will be connected in parallel with the load resistance, its own internal resistance must



be high compared with the load resistance, or the shunting effect of the instrument will reduce the effective value of the latter, and thereby decrease the sensitivity of the apparatus. The electrometers mentioned may have an internal resistance as high as  $10^{13}$  ohms, which is quite sufficient to render the shunting effect on even a 1000 megohm load resistance negligible, but for present purposes such instruments have been ruled out as unsuitable for reasons already given. No moving-coil instrument, of course, has an internal resistance of anything approaching this figure; hence, if such instruments are to be employed, valve amplification becomes essential.

There are, broadly speaking, two policies which may be pursued in regard to valve amplification; either the steady photoelectric current obtained when light is incident on the photocell may be passed through a load resistance as already described, and the D.C. potential difference between its ends amplified by means of a D.C. amplifier; or, alternatively, the photoelectric current may be suitably interrupted so as to give an alternating current through the load resistance at audio frequency, resulting in an A.C. potential difference across it, which is then amplified by means of a standard audio-frequency amplifier. The choice has, apparently, almost universally gone to the first method; but the second possesses so many advantages that it seems remarkable that it has not been seriously considered in practice. The only published work appears to be that of Hampson and Richards<sup>4</sup>, who used interrupted light and valve amplification with rectifier-type photocells to measure the whiteness of laundered fabrics.

D.C. amplifiers, if high gain is required, suffer from many disadvantages, of which the chief is that of instability. Unless separate insulated high-tension batteries, or their equivalent, are provided for every stage, coupling between stages occurs through the common impedance of the high-tension supply, and this cannot be eliminated by the decoupling arrangements used in A.C. amplifiers, since these are not applicable in D.C. circuits. As a result, D.C. amplifiers tend to be either elaborate as regards battery arrangements, or unstable, and the use of the mains as a source of high-tension supply is almost out of the question. Further, since slight variations in either high-tension or low-tension supplies cause exactly the same effects in the circuit as variations in the input potential which is to be measured, such supply variations are amplified together with the input voltage and superimposed upon the amplified output; while slow variations in supply voltage cause drift and an unstable zero. To this class of amplifier belongs the electrometer triode as used in valve potentiometers for the estimation of  $pH$  by means of the glass electrode. Here the effects mentioned are minimised by using only one stage, thereby avoiding instability due to inter-stage coupling; by supplying both high- and low-tension voltages from large-capacity accumulators, thereby minimising drift and spurious responses; and finally by using a null method with a sensitive microammeter in the anode circuit of the valve as indicating instrument. Under these circumstances a linear relation between input and output is not required, but it would not in any case be obtained except over comparatively small ranges. Cunliffe (*loc. cit.*) has recently described a method in which a photoelectric cell is used in conjunction with a valve potentiometer of the above type to measure the light absorption of coloured solutions. Finally, all D.C. amplification schemes as applied to photocells encounter the difficulties caused by stray light. The cell is quite unable to differentiate between light falling on its cathode from the source to be measured, and light coming from any other extraneous source. Consequently, stray light, whether daylight or artificial light, must be rigorously excluded, and this perhaps has not always been achieved as thoroughly as experimenters have hoped and desired. Its accomplishment generally involves either the use of a dark-room for the apparatus, or the enclosure of both the cell and the light source

in a light-tight box, all manipulation being performed from outside the box, and the lid closed during observations.

When A.C. amplification is used, the position is entirely different. Suppose the light from the experimental source is interrupted periodically by some suitable mechanical arrangement. The photoelectric current will then alternate in similar fashion, and an A.C. potential difference will be set up across the load resistance. Such a potential can be amplified, providing the periodicity of the alternation is suitable, by means of an audio-frequency amplifier, and the design of such amplifiers, of high gain and perfect stability, has reached a very high level as a result of the commercial developments of broadcasting. Instability through interstage coupling is completely eliminated by means of suitable decoupling arrangements, and since the amplification is dependent mainly on the shape of the valve characteristics, and is practically independent of high- and low-tension voltages over a reasonably large range (particularly if automatic grid bias is used), drift is minimised and a stable zero obtained. As output meter, an A.C. voltmeter of the metal-rectifier type may be employed. Such instruments are robust and of high internal resistance, and will stand a reasonable amount of misuse and temporary overloading without disastrous results. The power supply to the amplifier may very well be taken from the A.C. mains, after rectification and suitable smoothing, and valves are available with indirectly-heated cathodes suitable for A.C. supply through a step-down transformer. The output from such an amplifier can very easily be made a linear function of the input. Last, but by no means least, the stray light difficulty is removed; for if the stray light falling on the cathode of the photocell is "continuous" (i.e. non-interrupted) light, while it will cause an increased D.C. current to flow through the load resistance, and in consequence will give rise to a D.C. potential across its ends, this will have no effect on the amplifier providing the input to the first stage is taken, as it normally is, through a condenser. In actual practice, it has been found that the cathode of the photocell can be flooded with daylight while measurements are taking place without the slightest effect on the output meter. Stray light from lamps running on A.C. circuits produces a very minute A.C. component in the load resistance, due to the fact that the filament of an electric lamp, although of relatively high heat capacity, does follow to some slight extent in temperature the alternation of the supply voltage. As a result, large amounts of stray light from such sources do have some effect on the amplifier. It is a fairly simple matter to avoid such effects, by using apparatus in daylight only, or screening any auxiliary lamps that must inevitably be used. In any event the sensitivity to stray light, even from A.C. lamps, is enormously reduced as compared with that of a photocell connected to a D.C. amplifier, and using "continuous" light.

The basic apparatus (of which Fig. 1 gives a general view), falls naturally into three parts, the amplifier, the light source and its associated interrupter mechanism, and the cell and its potential supply. These three components will therefore be described separately. Other auxiliary apparatus required for individual applications will be described as these are dealt with.

### The Amplifier

The amplifier in its final form consists of a three-stage transformer-coupled circuit of conventional design. Details of construction will not be given, as they follow well-known and orthodox radio practice. Certain points arising in connection with the application of such an amplifier to quantitative work of the present character may, however, be of interest.

The chief difficulty encountered when attempts to find a suitable amplifying arrangement were first made, was that of hum in the output. All amplifiers deriving their power supplies from A.C. mains, and more particularly those employing A.C. for cathode heating purposes, generate hum,

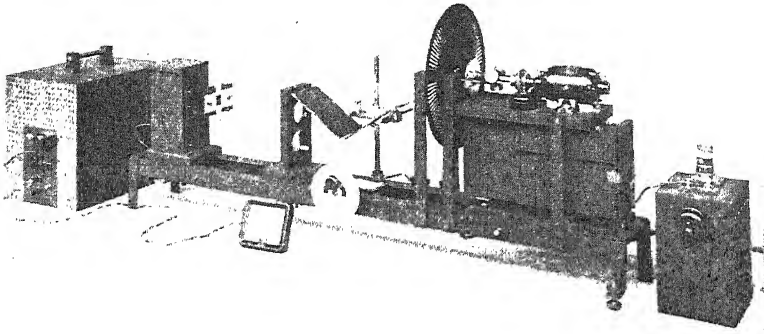


Fig. 1

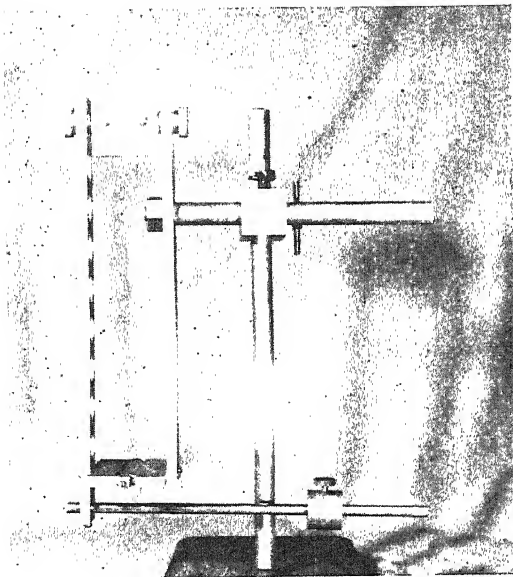


Fig. 6

Measurement of fibre diameter apparatus (p.T72).



to a greater or less extent, in their output. This hum, which has the effect of causing the amplifier to show a positive output with no intentional input, is due to a variety of causes, some of which are readily eliminated, while others can be overcome only with great difficulty. In the present case hum due to insufficient smoothing of the rectified high tension supply was obviated by means of a two stage choke-capacity filter with condenser input, followed by extra resistance-capacity filters formed by the usual decoupling arrangements, to the first two stages. Cathode bias was used on all stages, and the cathode bias resistance by-passed by large-capacity electrolytic condensers (see Fig. 2). The input circuit of the first valve was completely screened by

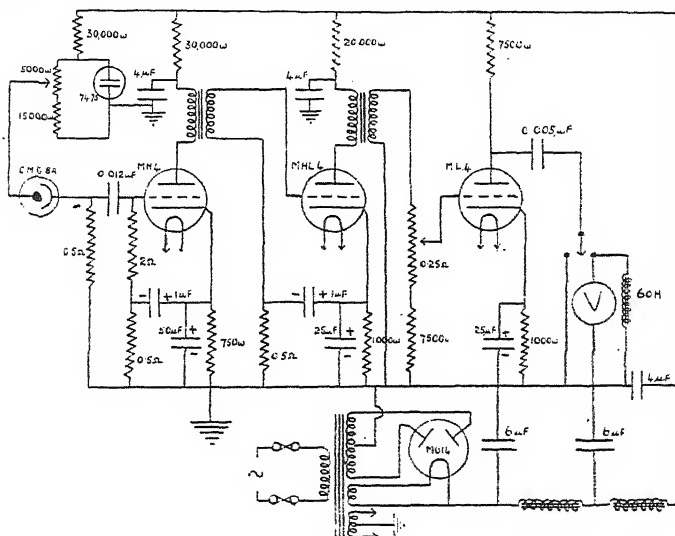


Fig. 2

enclosing it in an earthed sheet-iron box, and the lead to the grid of this valve from the photocell consisted of screened wire with the screening earthed. Transformer coupling was employed in preference to resistance-capacity coupling in order to keep the valve grids at low impedance to earth, and the grid circuits decoupled as shown in Fig. 2. The hum is approximately 0.40 volt at maximum gain, and decreases as the gain is reduced. This residual hum, which probably arises either from slight heater-cathode leakage or from capacitive coupling between heater and grid pins at the valve-holders, can be further reduced by reducing the grid-circuit impedance of the first valve, but this involves a reduction in the photocell load resistance and consequently a loss of sensitivity.

The valves (Osram) used in the amplifier are, first stage MH4, second stage MHL4, and output stage ML4, all triodes. The exact component values, together with the conventional circuit diagram, are shown in Fig. 2. The actual amplifier is built in two sections, the upper containing the power transformer, rectifier valve, and filter circuits, and the lower the amplifier proper. A sheet of soft iron covers the whole of the underside of the base-board on which the upper section is mounted, and is earthed, in order to prevent hum pick-up from the power transformer and first smoothing choke, which are also additionally screened. The whole is enclosed in a brass case which is also earthed, and the input and output are taken from opposite ends of the amplifier so as to avoid any possibility of feed-back resulting in instability.

The mains transformer is rated at 350-0-350 volts, which, after rectification, gives a smoothed high-tension voltage of approximately 360 volts at 30 milliamperes load. This voltage is adjusted by means of a resistance in

series with the first smoothing choke, which happens to have a resistance (D.C.) of only 250 ohms. If a higher-resistance choke were used, this resistance might not be necessary. In any event its value must be determined by trial and error, and it is therefore not shown in Fig. 2. The load resistance of the output valve (7500 ohms) carries approximately 13 m.a., and therefore dissipates approximately 1.3 watts. In order that 1-watt type commercial resistances may be used without overloading, four 30,000 ohm resistances are connected in parallel to give the 7500 ohm load, the wattage dissipated in each being then well within its rating. This device is adopted in several other cases to avoid overheating these composition resistances, and so to ensure stable performance from them. The output of the amplifier is taken across a 60 henry choke between the anode of the output valve and earth, using a  $.005\mu\text{F}$  series condenser to block the D.C. voltage at the anode; this arrangement serves as an output filter, still further reducing residual hum. A switch is arranged to short-circuit the meter during adjustments to the light-source and photocell, and so avoid accidental overloads as far as possible. The gain control of the amplifier consists of a 250,000 ohm potentiometer, in series with a 7500 ohm resistance, across the secondary of the second transformer, the moving contact of the potentiometer being taken to the grid of the third valve. With this arrangement, the 7500 ohm resistance prevents the gain from being reduced so far, even at minimum setting of the potentiometer, that the second valve grid is overloaded and linearity between input and output is upset. The range over which the voltage gain may be varied is from 500 to 16,000 (first valve grid to output meter), at 150 cycles, and the output is a linear function of input over the whole of this range.

Regarding the input circuit of the first stage, it has already been stated that the photocell is always used in conjunction with a load resistance, which converts the current output of the cell into a voltage output suitable for application to a valve amplifier. It might be thought that sensitivity could be increased very greatly by using high values of load resistance, but in practice several considerations militate against such a procedure. In the first place, the load resistance is in parallel with the input impedance of the valve; this latter is a complex quantity depending on several factors when A.C. voltages are concerned, but with commercial valves its value is rarely higher than about 10 megohms. Consequently, there can never be any virtue in making the cell load higher, or even as high, as this figure. Apart from the valve input impedance, if the input to the grid from the cell load resistance is taken through a condenser, then the valve must have an additional grid resistance in order to carry the bias voltage developed in the cathode bias resistor to the grid, and this also is in parallel with the load resistance. Since, on account of the hum difficulty already referred to, this grid resistor must have a reasonably low value, say two megohms or so, the load resistance will be seriously shunted by the grid resistor if its value is much greater than about 0.5 megohm. There is, in addition, a further reason for keeping the load resistance down to something of this order, at least when gas-filled photocells are to be used. In these cells, the photoelectric current is never saturated, i.e. independent of the voltage applied across the cell, as it is in the case of vacuum cells. In consequence, the "signal" voltage developed across the load resistance is always subtracted from the total voltage applied to the cell and load in series, leaving a portion only of this voltage to be applied across the cell, this portion being smaller, the greater the photoelectric current taken from the cell. The result of this is, in effect, that if the signal voltage constitutes any appreciable fraction of the total applied voltage, the cell is no longer working under constant voltage conditions, and the current output is no longer strictly proportional to the incident light. Hence, if linearity is demanded, the load resistance must have such a value that the signal voltage developed across it

is always a negligible fraction of the total voltage applied to the cell. For these reasons, the load resistance used in the present case is 0.5 megohm, and the grid resistor 2 megohms. The coupling condenser has a capacity of  $0.012\mu\text{F.}$ , and is a good-quality mica-dielectric one. It is essential that this condenser shall have negligible leakage, otherwise D.C. potentials developed across the load resistance as a result of stray light, photocell dark current, insulation leakage, etc., will be transferred via the leaky input condenser to the first valve grid, with unpleasant consequences as regards stability of output and drift. Campbell and Ritchie<sup>5</sup> recommend a load resistance of 0.25 megohm, coupling condenser  $0.01\mu\text{F.}$ , grid resistor 2 megohms, in very close agreement with these experimental values.

The output of the amplifier is a linear function of input up to the limit of the output meter scale, and the same is true at minimum gain. Maximum gain at 150 cycles is approximately 16,000, or 98 decibels (input 1 mv across 0.5 megohm, output 16 v across 20,000 ohms). Since only one fixed frequency is to be amplified in the present case, the shape of the frequency characteristic is of little importance, except in assessing what variation of frequency may be permitted in the interrupter without serious error. It is of normal shape for a transformer-coupled amplifier.

#### The Light Source and Interrupter Mechanism

The light source used is a gas-filled automobile headlamp bulb, rated at 36 watts at 6 volts, and is supplied from an A.C. transformer. The secondary voltage of the transformer is 12 volts, the extra 6 volts being dropped in a barretter (Philips, No. 1012) connected in series with the lamp. This barretter passes 6 amps. at any voltage between 5 and 30 volts, and serves to stabilise the light source to a very considerable extent. It is not capable of dealing with short-period fluctuations in the supply, but does ensure that long slow variations are effectively smoothed out, and so prevents zero drift due to this cause. Rapid, small fluctuations round the mean are of little importance.

The lamp is contained in a ventilated lamp-house having a condensing lens 2 in. in diameter and 6 in. focal length, so that a parallel beam may be thrown on to the interrupter disc. The latter consists of a brass disc 12 in. in diameter, pierced with 96 radial slots, each  $1\frac{1}{8}$  in. long, arranged with their inner ends on a pitch circle of 3.82 in. radius. Each slot is  $\frac{1}{8}$  in. wide at this end, opening out to  $11/64$ ths in. at its outer extremity, and they are therefore separated by a solid portion of the disc equal in width to the slot. The disc rotates in front of a mask pierced with seven slots identical with those in the disc, and the light beam is directed so as to pass through the slots of the mask and disc when these are coincident. When the disc is rotated therefore, the light beam is completely interrupted 96 times per revolution, giving, at 800 revs. per minute, a frequency of about 1300 cycles/second to the A.C. component of the photocell current. The disc is mounted in ball bearings, and driven by means of a  $1/40$ th H.P. A.C. commutator motor. Its speed is controlled by a centrifugal governor of the friction type, similar to that used for controlling electric gramophone motors. Measurements of disc speed made with the Ashdown Rotoscope indicated that the governor was capable of maintaining a speed constant within  $\pm 5$  revs./min. at 800 revs./min. for an indefinite period. The details may be seen in Fig. 1.

The periodicity of 1300 cycles/second was used in order that the amplifier should operate on as high and flat a portion of its frequency characteristic as possible; maximum sensitivity is thus obtained and minimum errors due to small variations in interrupter disc speed. The wave-form of the A.C. current generated in the photocell by light interrupted by a disc of the type described is not sinusoidal, but tends to be rather triangular. The output meter, being sensitive to wave-form as are all metal-rectifier instruments,

will thus not measure accurately the RMS value of the output. This is of no consequence, however, since the wave-form is constant for a given disc at constant speed, and the output is not required in volts, but only in known arbitrary units.

#### The Photocell and its Potential Supply.

The photocell used is an Osram CMG8A caesium-silver oxide gas-filled cell, and is mounted in a light-tight sheet-iron box, the latter being earthed as a protection against pick-up of stray A.C. fields. The particular cell used was marked for a normal supply voltage of 80 volts, this being approximately 0.6 of the glow-discharge voltage in the dark. The cell can be run at higher voltages than 80, provided that bright lights do not fall on it when the voltage applied is high, and so initiate the glow-discharge. The cell supply voltage is taken from the rectified and smoothed H.T. supply of the amplifier as shown in Fig. 2. A 30,000 ohm fixed resistance, in series with a 5,000 ohm potentiometer and a 15,000 ohm fixed resistance, is connected between the +H.T. line and earth. The current through all three is thus approximately 7 m.a. and the voltage drop across the potentiometer and 15,000 ohm resistance 140 volts. A neon voltage regulator (Mullard 7475, 140 volts striking, 95-100 volts running) is connected across the latter combination, and thus strikes when the H.T. supply is switched on. Thereafter it maintains the P.D. across the potentiometer + 15,000 ohm resistance combination at 96 volts. One end of the potentiometer is thus at 96 volts above earth potential, the other at +72 volts approximately. The cell anode is connected to the moving contact of this potentiometer, and the cell voltage can thus be varied from 72 to 96 volts, the mid-scale value being 84 volts. The neon stabiliser was found to be extremely effective in maintaining a steady potential to the cell.

The photocell housing has an aperture in the side facing the cell cathode, and over the aperture is fitted an ebonite extension chamber with removable lid, and grooved internally so that light filters or a ground-glass diffusing screen can be inserted in the path of the light reaching the cathode. This extension terminates in an adjustable slit defined by two pairs of overlapping metal plates so that it is adjustable both in width and length. In this way rough adjustments to the amount of light falling on the cell may rapidly be made.

#### Constancy and Linearity of the Apparatus

It is above all necessary that a direct-reading instrument shall be constant, i.e. both give reproducible readings under a standard set of conditions, and be free from zero drift. It is also a great convenience if the final calibration curve, relating the quantity to be measured to the output reading of the instrument, is a straight line. Calibration need only then be performed at one or two points instead of over the whole range to be covered.

In the present case the constancy of the apparatus was tested by allowing a small amount of light from the source to fall on the cell cathode through an aperture approximately  $1.0 \times 0.1$  mm., a ground-glass diffusing screen being used in front of the cell to prevent the light from being concentrated on one tiny spot on the cathode, and an output reading of 10 volts was obtained by adjusting the amplifier gain. Leaving the conditions unchanged, the reading was observed every day for several hours over a period of several days, the amplifier, light, and motor being switched off each night. It was found that the whole apparatus required about  $1\frac{1}{2}$  hours after switching on from the cold to attain steady working conditions. This is by no means unusual, as a steady voltage output cannot be expected until valves, transformers, chokes, resistances, the barretter in the light supply, etc., have achieved their steady working temperatures. After this initial period, the reading was found to remain steady, apparently indefinitely, within  $\pm 1.0$  per cent., i.e. the voltmeter reading remained between 9.9 and 10.1 volts.



Very occasionally an excursion of as much as 0.5 volt was observed, but such variations were invariably of short duration, a few seconds at most, and were attributable to the fact that the building in which the apparatus was used contained a large number of induction motors driving heavy machinery, which were started and stopped fairly continuously during the period of the observations. If constancy is to be maintained, lenses, lamp-bulb, and the photocell itself must be kept free from dust, finger-marks, and the peculiar translucent film that is apt to deposit on glass surfaces exposed to the air of many laboratories, particularly these containing a miscellaneous assortment of chemicals.

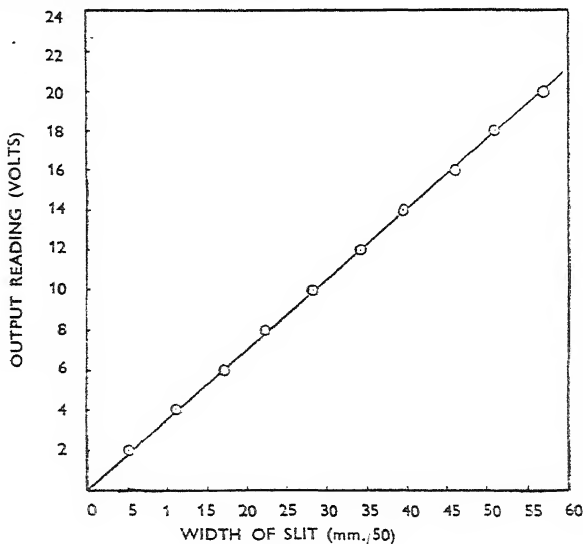


Fig. 3

As regards linearity, it is not of course possible to ensure that a linear output is obtained under all possible circumstances. Provided that the phenomenon or property to be measured can be made to modify the incident light beam in a linear manner, then linearity of output is possible; but if this is not the case, as, for example, in determining the concentration of solutions of coloured substances which do not obey the Lambert-Beer Law, then linearity is not to be expected. In the present case all that was sought was to show that the output reading was a linear function of the total amount of light falling on the photocell cathode. In order to test this point, a Brown and Sharpe vernier caliper was used. This instrument was set up in front of the photocell, its jaws being used as a parallel slit whose width could be adjusted at will and determined accurately from the vernier of the instrument. This slit was illuminated by throwing upon it an enlarged image of the centre slit of the interrupter mask. Evenness of illumination over the range to be covered was ensured by using only the centre slit of the mask, and only the centre portion of this slit. Readings of output voltage against slit width were taken, using as before a ground-glass diffusing screen to spread the light over the whole of the photocell cathode, and thus avoid errors due to varying sensitivity from point to point of the photoelectric surface. The results obtained are shown in Fig. 3 and indicate that the output is a linear function of the light input, and the straight line obtained passes through the origin. According to Campbell and Ritchie (*loc. cit.*), doubt has been cast by some workers on the possibility of true linearity between light input and electrical output in the case of gas-filled photocells; while it is possible that when such cells are used in bright lights and near the glow-discharge point linearity may not be obtained, it is plain

that in the present case, using very feeble lights and an anode voltage well removed from the glow-discharge potential, perfect linearity is found. As Campbell and Ritchie remark, experiments in which linearity is achieved have greater evidential value than those in which it is not, because the cause of such departure from linearity may lie not in the photocell but in the way it is used. In addition to too high a potential and too bright a light, other possible sources of non-linearity lie in the use of too high a load-resistance, or a non-linear amplifier, and in stray light effects.

#### Applications of the Apparatus

(1) *As Nephelometer or Absorption Colorimeter.* The apparatus is readily adapted for use as a nephelometer.

As an example may be quoted the results obtained in the determination of sulphuric acid in a sample of A.R. perchloric acid. A calibration curve was first obtained using a solution of A.R. potassium sulphate made acid with hydrochloric acid, suitably diluted, and precipitated with barium chloride solution in a plane-parallel glass cell placed in the light beam. 10 c.c. of the sulphate solution were placed in the test cell, and 1 c.c. of 5*N* HCl was added. The output reading was then adjusted in all cases to 20 volts. 5 c.c. of 10 per cent. barium chloride solution were added, the mixture stirred rapidly with a glass rod, and the new reading taken as soon as it became steady, usually after about 2 minutes. Table I and Fig 4 show the results obtained.

Table I

mg. Sulphate (as $\text{H}_2\text{SO}_4$ ) present	Output reading 2 min. after adding $\text{BaCl}_2$
0.0	20.0
0.05	18.5
0.10	17.3
0.15	15.5
0.20	13.4
0.25	11.8
0.30	11.0
0.35	9.8

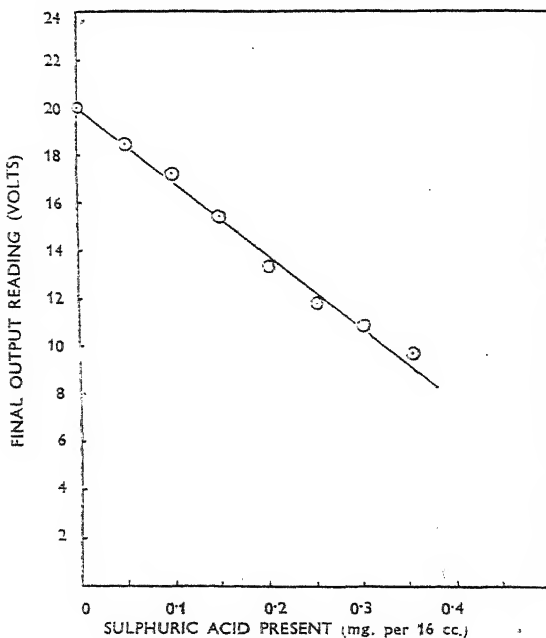


Fig. 4

The reduction in output reading is a linear function of the sulphate present up to 0.35 mg  $\text{H}_2\text{SO}_4$  (after which readings became irregular owing to settling and flocculation). 10 c.c. of A.R. perchloric acid were then placed in the cell and treated exactly as before. The reduced reading was 18 volts, indicating a sulphuric acid content of 0.06 mg. in 16 c.c., or approximately  $0.6 \times 10^{-3}$  per cent. (w/v). It is difficult to see how such a quantity could be estimated with the same accuracy by any gravimetric or volumetric method.

The apparatus can obviously be used as an absorption colorimeter for the determination of dissolved coloured substances such as dyestuffs. In many cases light filters will be required in order to obtain maximum sensitivity. Cunliffe's paper (*loc. cit.*) gives an excellent account of the technique, which can be applied in the present case. The CMG8A photocell is not the best type to use in this connection, its maximum sensitivity lying in the red and near infra-red. The KMV6 potassium-silver oxide cell has some sensitivity over the whole of the visible spectrum and is better adapted to colorimetric measurements. This is not to say that satisfactory measurements cannot be made with the CMG8 cell, despite its inordinate sensitivity in the infra-red, as the following example shows.

Alizarin Light Blue RG (Sandoz) is a level-dyeing acid colour which is practically transparent to infra-red in aqueous solution; if the infra-red is filtered from the incident light by means of a copper chloride filter, the filtered light is blue, the dyestuff does not absorb strongly in the blue, and in any event the photocell is insensitive to blue light. Hence, the determination of this dyestuff with the caesium cell presents possibly as difficult a case as could be found. The difficulties were overcome to an extent sufficient to make an accurate determination possible by screening the majority of the infra-red out of the incident beam, using a green filter which still left a yellow or orange component of reasonable magnitude in the filtered light. For this purpose a green glass filter of unknown origin was used (possibly a glass coloured with copper compounds), but a dilute solution of 50 per cent. basic chromium sulphate used as a liquid filter was found to be equally effective. The results obtained in calibrating the apparatus with standard solutions of the above dyestuff and light filtered in this manner are given in Table II and Fig. 5.

Table II

Concentration of dyestuff (% w/v) (C)	Transmitted light (volts) (I)	Transmitted light (corrected volts) (I - I <sub>R</sub> )	log(I - I <sub>R</sub> )
0.0	20.0	12.8	1.11
0.2 $\times 10^{-3}$	18.6	11.4	1.06
0.4	16.5	9.3	0.97
1.0	13.7	6.5	0.81
2.0	11.0	3.8	0.58
3.0	9.5	2.1	0.32
4.0	8.6	1.4	0.15
6.0	7.6	0.4	-0.40

The absorption equation  $I - I_R = I_0 e^{-kC}$  is obeyed by these results, as Fig. 5 shows,  $I_0$  being the total intensity of incident light,  $I$  that of the transmitted light, and  $I_R$  that of the non-absorbable component of the incident light; while  $C$  is the concentration of the dyestuff in solution.

(2) *Measurement of Fibre Diameter.* The principle adopted for the measurement of wool fibre diameter is that of inserting the fibre to be measured between the edges of a pair of jaws, which otherwise meet so

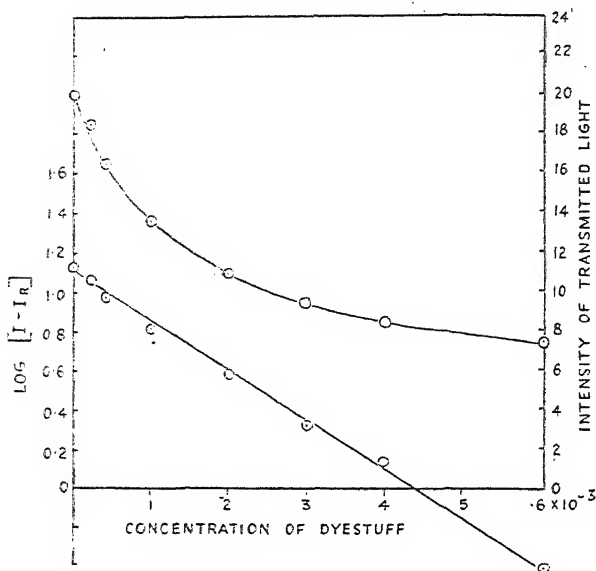


Fig. 5

accurately as to prevent any light passing through at the line of junction. The fibre thus holds the jaws apart, forming a narrow slit whose width is equal to the fibre diameter. Through this slit light is allowed to pass on to the cell, and the output thus obtained is a linear function of the fibre diameter. The actual apparatus is shown in Fig. 6.

The two stainless steel jaws are rectangular in shape,  $\frac{1}{4}$ -inch thick, chamfered to a thickness of approximately 1 mm. along the contact edge. A narrower contact face was not considered advisable, since even with light loading, the pressure on the fibre would become high, and distortion of the cross-section might result. Each jaw is mounted at the end of a rigid arm, and is adjustable in all directions so that accurately parallel setting is possible. The arms are pivoted together on steel needle-point bearings at a distance of 9 inches from the jaws, pivot friction being so small as to be negligible. One arm is clamped rigidly in a vertical position, and the other carries, at right angles to itself and attached below the pivot, a counter-balance arm with a sliding bobweight by means of which the pressure between the jaws when they are closed can be accurately adjusted. The jaws themselves are precision ground and lapped by hand into optical contact. A small semi-circular notch is filed in each jaw 1 mm. below its top edge, and the fibre is always inserted between this notch and the edge of the jaw. It is necessary that the point of insertion shall always be the same within narrow limits, owing to the fact that the slit obtained is not parallel, and the same fibre inserted, say at the bottom edge of the jaws, would open a wider slit than when inserted at the top edge. With the safeguard described, the possible variation of the position of insertion is not more than 1 mm., and the possible error due to this cause is limited to less than 0.5 per cent. with a pivot-to-jaw distance of approximately 230 mm.

The performance of the apparatus was checked against the microscope as follows:—Two uniform metal wires were available, one of steel with an optical diameter of 18 to 18.5 eyepiece micrometer divisions; the other, and rather more uniform, of tungsten with a diameter of 12 eyepiece divisions. A length of the tungsten wire was inserted between the jaws as standard, and the output adjusted, for comparative purposes, to 12 volts, giving 1 volt per eyepiece division. The steel wire was then found to give 18–18.5

volts output, i.e. the calibration curve is linear, and either wire can be used for setting purposes. Next, four individual wool fibres of varying diameter, 5 cm. long, were measured with the microscope at 10 points along their length, and also 10 readings were taken on each with the photometer. The means of these results are given in Table III.

Table III

Fibre	Microscopic diameter (eyepiece divisions)	Photometric diameter (volts output)
Tungsten wire (standard) ... ..	12.0	12.0
Steel wire ... ..	18.0-18.5	18.0-18.5
Human hair (minor axis) ... ..	16.0	16.39 } repeat 16.41 } determination
Cotswold ... ..	10.75	10.30
Lincoln ... ..	7.95	7.88
Merino (64's) ... ..	4.60	4.51

All micrometers involving the jaw principle tend preferentially to select the minimum diameter if the fibre to be measured is slightly elliptical in cross-section; whereas the microscopic method, in which the fibre is in effect mounted between transparent jaws (slide and coverslip) but measured at right angles to them, tends to do the reverse. Hence, in general, the diameters as measured microscopically tend to be slightly higher than when measured photometrically. In the extreme case of human hair, a smooth fibre having an elliptical cross-section of considerable eccentricity, the photometer will not measure the major axis at all, but invariably selects the minor axis, as the results indicate. With the microscope, it is generally difficult to measure the minor axis at all, unless the fibre has several turns of twist deliberately inserted into it before examination. This procedure is open to objection on the ground that the cross-section may be distorted by the strain imposed on the fibre, and focusing difficulties are increased, but was used in the present case to obtain the minimum diameter of the human hair measured.

As the difference between the photometric and microscopic diameter is greatest in the case of human hair, a further test was carried out, in which fifty hairs were measured photometrically, and fifty others of the same sample had their diameters determined microscopically, by cutting cross-sections and measuring the major and minor axes from the sections. The results are given in Table IIIA.

Table IIIA

	Mean diameter ( $\mu$ )	Standard deviation $\sigma$	$\frac{2\sigma}{\sqrt{n}}$ ( $n=50$ )
Photometrically ...	55.8	10.3	1.54
Microscopically ...	54.9 (minor axis)	11.6	1.57

Since the difference between the two mean values for diameter is less than twice the standard error of either, the values do not differ significantly.

The actual value of one eyepiece division, determined by stage micrometer calibration, was  $4.27\mu$ . The diameter of the tungsten wire used as standard is thus  $51.24\mu$ . If the output is set to 17.08 volts with the standard in the jaws, the output meter will read  $3.0\mu$  per volt; set to 12.8 volts with the standard,  $4.0\mu$  per volt, and set to 10.25 volts,  $5.0\mu$  per volt. If a suitable standard is available the ultimate sensitivity can be increased to about  $1.0\mu$  per volt by using maximum amplifier gain. The accuracy of individual readings is considerably greater than that obtainable microscopically, since the voltmeter scale is easily read to 0.1 volt, whereas the

eyepiece micrometer can rarely, on account of the focusing difficulties already referred to, be read to a closer accuracy than 0.5 division. The apparatus is also directly applicable to the measurement of the thickness of films, metal foils, paper, etc., and, with the addition of suitable contact surfaces of greater area, to that of fabrics under known and controllable pressure.

(3) *Use as Optical Density Meter for X-Ray Photographs.* In order to adapt the photometer to the estimation of the position and intensity of the spots on X-ray fibre photographs, a narrow slit was constructed by cementing two safety-razor blades side by side on to a glass slip, leaving a gap of approximately 0.05 mm. between their edges. The length of the slit was defined by means of two pieces of opaque paper gummed to the opposite side of the glass, leaving a clear slit 2 mm. long. A mechanical microscope stage having verniers reading to 0.1 mm. was used to hold the X-ray plate in a vertical position in front of the photocell, the slit being fixed in front of the plate so that the razor-blades slid over the film side of the plate as the latter was traversed behind it; this arrangement ensured that the photo-

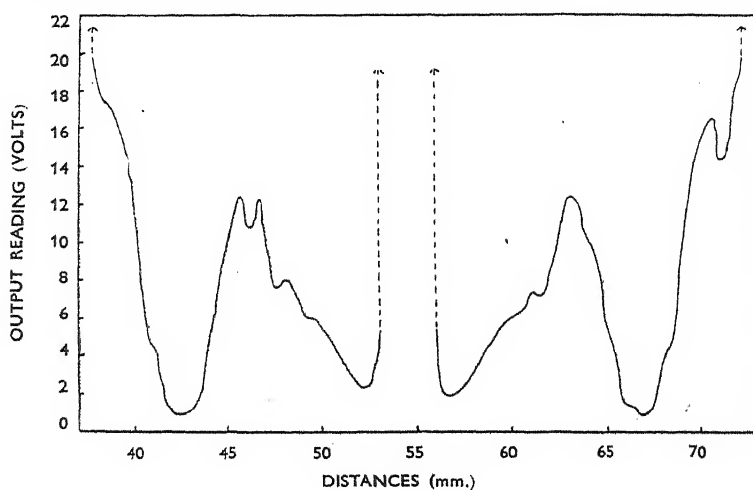


Fig. 7

graphic image and the slit opening were very approximately in the same plane. The position of the plate could be read from the verniers of the mechanical stage, while the slit, illuminated by forming an image of the lamp filament upon it with an auxiliary lens, passed light to the photocell in proportion to the density of that part of the photographic image which it covered at any particular moment. Fig. 7 shows the curve obtained in travelling along a centrally-situated part of the meridian of a fibre photograph. The whole of the plate cannot be examined at one amplifier setting unless detail is sacrificed near the centre, because the outer parts of the photograph are generally much less dense than the central zone where the important spots are often situated.

It is not suggested that the present example represents the ultimate sensitivity and resolution to be obtained from the photometer in this application. A more refined optical system, focusing a narrow image of an illuminated slit actually in the plane of the photographic image, would doubtless give greater resolution in complex spots, and experiments are proceeding in this direction. The figures suffice to show, however, the applicability of the apparatus in this connection.

(4) *Use as Glossmeter and Reflection Colorimeter.* The surface reflectivity and lustre of textile fabrics have been examined by means of a slight modification to the optical system of the apparatus. The parallel beam from the

interrupter disc is received on an inclined plane mirror, and directed downward at an angle of approximately  $30^\circ$  to the vertical to fall upon the sample to be examined, lying on a horizontal table, as shown in Fig. 1. Reflected light from the sample is received on a second inclined mirror, which directs it horizontally to an auxiliary lens, by which it is focused on the photocell cathode. The table holding the sample can be rotated about an axis passing through its centre, horizontally and at right angles to the direction of the light beam. A graduated dial indicates the angle through which the sample table is displaced from the horizontal.

If a high-reflecting surface, such as a mirror or sheet of glass, is placed on the specimen table, then, with the table horizontal, the reflected beam is directed into the photocell; but if the table is rotated either way from horizontal through an angle  $\theta$  the reflected beam is rotated through an angle  $2\theta$ ,

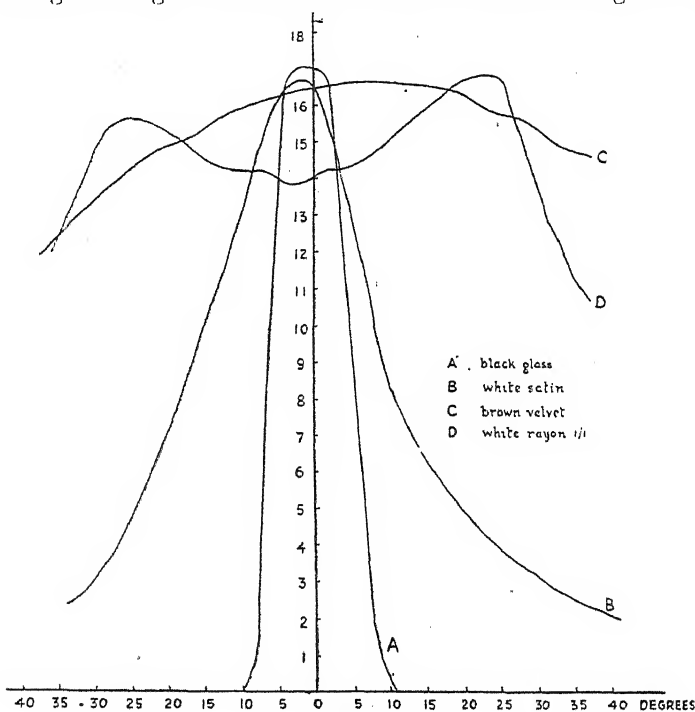


Fig. 8

and no longer falls on the cell. Instead, the cell receives any light diffusely reflected from the surface at an angle  $2\theta$  on one side of the specular direction, or position of the reflected beam. Thus, by plotting photometer output against angle of rotation of the specimen, a curve is obtained showing the intensity of the reflected light along the specular direction, and also at increasing angles on either side of it. Some curves for different materials obtained in this way are shown in Fig. 8. (These curves are not comparable as regards the axis of ordinates, the sensitivity of the amplifier having been adjusted in each case to give approximately the same output reading at maximum reflectivity.) The curve for the black glass should theoretically consist simply of a straight vertical line coincident with the axis of ordinates. In practice, however, the finite size of the light beam (which is necessary if an average sample of the surface is to be surveyed), and of the photocell cathode cause a spread of the kind shown. This curve is included for comparison purposes, as showing the order of selectivity to be expected with a highly-reflecting surface. The curve for white rayon, a typical fabric of high lustre, shows well-marked reinforcement of the reflected light along the

specular direction, as would be expected, whereas that for brown velvet (upright mohair pile, and therefore non-lustrous), shows very little reinforcement, but an almost flat distribution of diffusely-reflected light on each side of the specular direction. It is suggested that the ratio between the height of the peak and the spread of the curve can be used as a relative measure of lustre in a fabric. The remaining curve is interesting as illustrating one effect of fabric structure on surface reflectivity. It was obtained from a rayon fabric in which the weft was straight, whereas the warp threads did most of the necessary bending as the fabric was woven. The reflection curve shows two peaks symmetrically placed at an angle of  $\pm 12^\circ$  from the specular direction, the fabric being illuminated along the direction of the warp. There is no doubt that the peaks are caused by the inclined floats of the warp threads, which become horizontal when the fabric is suitably tilted, and then constitute a set of reflecting planes with a specular direction of their own, inclined to that of the fabric in general. From the positions of the two peaks, it is possible to deduce the angle through which the warp threads in the fabric bend. The "shot" effect in bicolour shot silk fabrics is probably of this nature.

An obvious extension of this type of measurement is the determination of the depth of colour of dyed patterns. For this purpose the sample is laid on the specimen table and the diffusely reflected light measured at some considerable angle to the specular direction, so as to avoid the effect of lustre. Generally, the table is tilted backwards until the specimen is illuminated normally; the light diffusely reflected at an angle of approximately  $40^\circ$  from the normal then falls on the photocell. It is not claimed that fabrics differing widely in structure and material, say satin and velvet, could be examined as to their colour in this manner, but the necessity frequently arises for determining the relative depths of shade of a number of samples, generally of identical material and dyed with the same dye; for example in the testing of resist processes, or the measurement of fading. Here the method is rapid and convenient.

#### SUMMARY

A general-purpose photoelectric photometer suitable for routine use in textile laboratories is described, and some constructional details given.

Typical results are quoted, which have been obtained in using the photometer as nephelometer, absorption colorimeter, fibre diameter micrometer, glossmeter, and photographic density meter.

#### ACKNOWLEDGMENTS

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#### Correction. Vol. XXXV, No. 4.

**On the Existence of a Critical Temperature for Milling.** By J. B. Speakman, J. Menkart and W. T. Liu.

Page T44, line 14: for "20" read "28".

" " line 15: for "20" read "28".

" " line 16: for "4.2" read "5.2".



# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 7—THE ACTION OF PHENOL ON WOOL

By T. BARR and J. B. SPEAKMAN

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It is already known that wool dissolves with decomposition in hot phenol,<sup>1</sup> but the fact that wool fabrics undergo rapid and pronounced shrinkage when they are immersed in melted phenol appears to have been overlooked. This observation was made during the course of another investigation, and it seemed to merit further study so that the cause of shrinkage could be elucidated and its practical applications developed.

#### EXPERIMENTAL

In the original experiment to which reference has just been made, a pattern (2.67 g. air-dry\*) of all-wool flannel was immersed in phenol (100 g.) for 15 minutes at 80° C. When the pattern was removed, it was found to have shrunk 27.1 per cent. in area, and even after an overnight wash in running water, the residual shrinkage was 10.9 per cent. Before attempting to discover the cause of shrinkage, experiments were carried out to define the optimum conditions for its occurrence by studying the influence of the time and temperature of treatment and the effect of adding varying amounts of water to the phenol. The work was carried out with fabric A, which had the characteristics shown in Table I, but two other fabrics, B and C, were also used for the purpose of discovering the extent to which shrinkage is influenced by the structure of the fabric.

Table I

	Fabric A	Fabric B	Fabric C
Count of warp yarn ... ..	28 skeins	16 skeins	2/36s worsted
Count of weft yarn ... ..	28 "	20 "	2/36s "
Ends per inch ... ..	34	32	72
Picks per inch ... ..	34	35	60
Weight per sq. yd. (oz.) ... ..	5.40	8.51	7.40

#### Factors influencing the Extent of Shrinkage

(1) *Time of treatment.*—Five patterns of fabric A, each weighing 2.5 g. air-dry, were immersed together in 250 g. phenol at 50° C. To facilitate shrinkage measurements, a 10 cm. square was marked out on each pattern in coloured cotton, the area of the square being re-measured when the pattern was removed from the phenol, and again after it had been washed in three changes of water at 35° C., using 500 ccs. each time, followed by running water for 30 minutes. Patterns were removed from the phenol at intervals, and the results of the shrinkage measurements are given in Table II, illustrated by Fig. 1.

\*Throughout this paper, the term "air-dry" implies conditioning at 65 per cent. relative humidity and 72° F.

Table II

Time of treatment (minutes)	Percentage shrinkage in area	
	In phenol	After washing
1.0	6.9	5.0
2.5	9.7	7.8
5.0	15.4	9.7
10.0	22.6	16.3
15.0	24.3	15.4

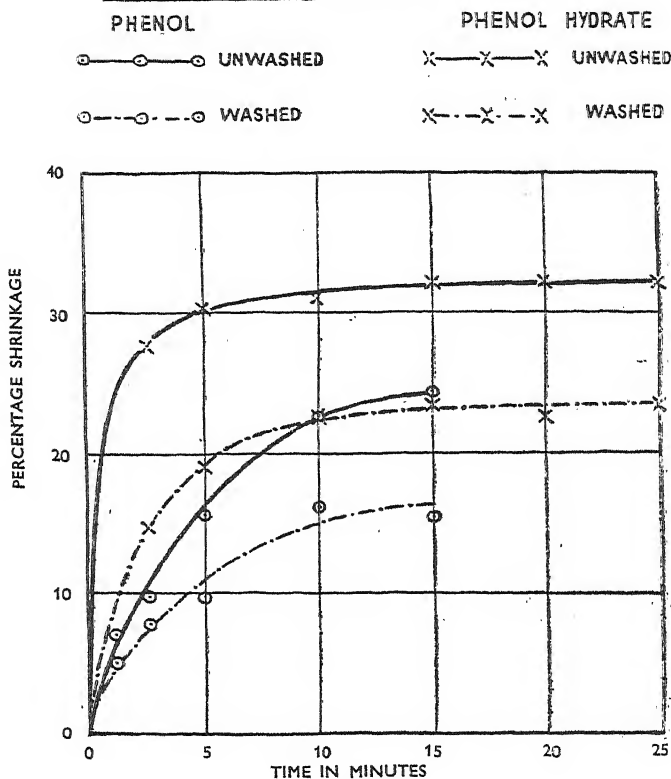


Fig. 1

Shrinkage appears to be fairly complete in 15 minutes, and the rapidity of the process was confirmed by further experiments with a mixture having the composition of phenol hydrate<sup>2</sup>  $[(C_6H_5OH)_2H_2O]$ . In this case, each 2.5 g. pattern, on which a 10 cm. square had been marked out in coloured cotton, was immersed in 100 g. of the mixture at 80° C. Patterns were treated for times varying from 2.5 to 25 minutes, and the results of the shrinkage measurements are given in Table III, illustrated by Fig. 1.

Table III

Time of treatment (minutes)	Percentage shrinkage in area	
	In phenol hydrate	After washing
2.5	27.7	14.5
5.0	30.3	19.0
10.0	31.1	22.6
15.0	32.0	23.4
20.0	32.0	22.6
25.0	32.0	23.4

(2) *Temperature of treatment.*—Squares were marked out on 2.5 g. patterns of fabric A in the usual manner, and the patterns were then treated with the phenol hydrate mixture for 15 minutes at different temperatures. Each pattern was separately immersed in 100 g. of the mixture, and the extent of shrinkage was measured before and after washing. The results are summarised in Table IV, illustrated by Fig. 2.

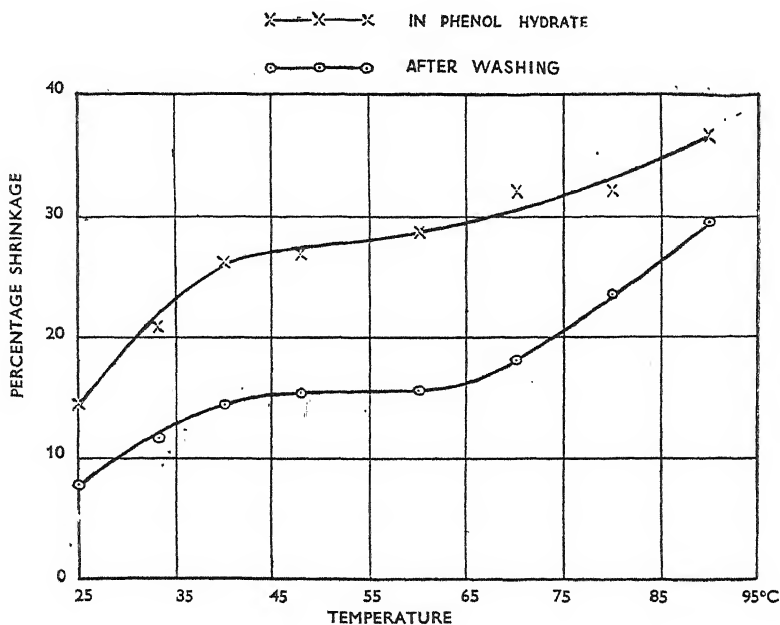


Fig. 2

Table IV

Temperature of treatment (° C.)	Percentage shrinkage in area	
	In phenol hydrate	After washing
25	14.4	7.8
33	20.7	11.6
40	26.2	14.5
48	26.8	15.3
60	28.6	15.4
70	32.0	18.0
80	32.0	23.4
90	36.7	29.5

As shown in Fig. 2, the extent of shrinkage first increases with rise of temperature up to 40° C., then remains practically constant between 40° and 60° C., and finally again increases up to 90° C.

(3) *Structure of the fabric.*—To discover whether the structure of a fabric affects the extent of its shrinkage in phenol, 2.5 g. patterns of the fabrics described in Table I were immersed in 100 g. phenol for 15 minutes

Table V

Fabric	Percentage shrinkage in area	
	In phenol	After washing
A	24.4	10.6
B	18.3	7.8
C	18.1	5.9

at 50° C. The areas of the marked squares were re-measured before and after washing, and the shrinkages are shown in Table V.

All the fabrics contract in phenol, and in all cases part of the shrinkage persists after washing, but it is evident that the structure of a fabric has a considerable influence on both the initial and final shrinkages.

(4) *Addition of water to the phenol.*—Patterns of fabric A, each weighing 2.5 g. air-dry, were marked out with 10 cm. squares in the usual manner and then immersed for 15 minutes at 80° C. in 100 g. of the mixtures shown in Table VI. The areas of the squares were re-measured when the patterns were removed from the mixtures, after they had been given the usual wash, and after a final prolonged wash of 24 hours in running water. A summary of the observed shrinkages is given in Table VI, illustrated by Fig. 3.

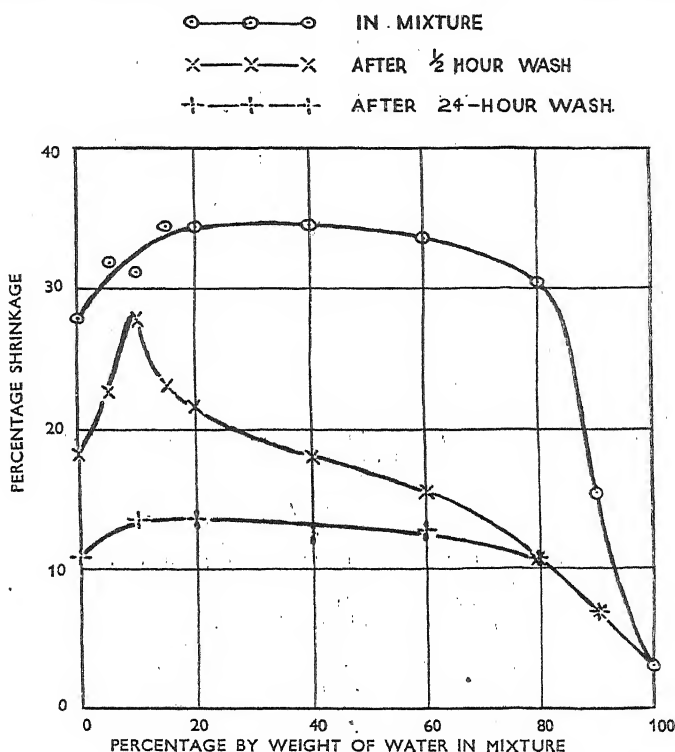


Fig. 3

Table VI

Percentage by weight of water, in mixture	Percentage shrinkage in area		
	In mixture	After 1/2-hour Wash	After 24-hour wash
0	27.8	18.1	10.8
5	32.0	22.6	—
10	31.2	27.8	13.5
15	34.4	23.1	—
20	34.4	21.6	13.5
40	34.4	18.1	12.6
60	33.6	15.4	12.6
80	30.4	10.7	10.8
90	15.4	6.9	6.8
100	Soaked for 24 hours at room temperature 3.2		

The shrinkage of the unwashed fabric increases with increasing water content of the mixture up to 15 per cent., and then remains approximately constant until the water content is about 60 per cent., beyond which point there is a rapid fall. After a  $\frac{1}{2}$ -hour wash, however, shrinkage is most pronounced in the case of a fabric treated with a mixture containing just under 10 per cent. of water, corresponding to the existence of the hydrate  $(C_6H_5OH)_2H_2O$ . If the latter should function as a weak dibasic acid, causing intense swelling of the fibres, shrinkage might well be due to this cause, though it provides no immediate explanation of the large amount of shrinkage which persists after a 24-hour wash and all the phenol is removed. Before proceeding to study the cause of shrinkage, however, the general validity of the preceding observations was confirmed by similar experiments with fabrics B and C. The results are given in Table VII.

Table VII

Percentage by weight of water in mixture	Percentage shrinkage in area		
	In mixture	After $\frac{1}{2}$ -hour wash	After 24-hour wash
FABRIC B			
0	27.8	10.8	10.8
5	28.6	14.5	10.8
10	30.3	13.6	10.8
15	30.3	10.7	10.8
20	31.1	10.7	8.8
40	28.6	9.8	8.8
60	27.8	7.9	7.9
80	25.2	6.8	6.8
90	9.7	5.0	5.0
100	Soaked for 24 hours at room temperature		2.0
FABRIC C			
0	22.6	8.8	7.9
5	23.5	10.6	7.9
10	24.4	10.6	7.9
15	23.6	9.8	8.9
20	23.6	7.9	6.9
40	23.6	8.9	6.9
60	22.7	7.9	6.9
80	20.8	6.9	6.9
90	16.4	5.0	5.0
100	Soaked for 24 hours at room temperature		3.9

### The Cause of Shrinkage

From first principles, it is evident that the shrinkage of wool fabrics in phenol and mixtures of phenol and water must be due to one or other of the following causes: length contraction of individual fibres, lateral swelling of the fibres, or relative movement of the fibres, as in milling.

The first of these possibilities was examined by determining the length contraction of wool fibres in phenol. Single fibres of 64s merino wool were mounted in stainless steel setting frames<sup>9</sup> and their air-dry lengths measured by means of a travelling microscope. After the fibres had been slackened by screwing down the upper grips, the frames were immersed in phenol at 50° C. for 5 minutes. The fibres were then drawn just taut and their lengths re-measured in the phenol. The frames were afterwards transferred to running water, and when the slackened fibres had been washed for 15 minutes, they were allowed to dry in room air before re-measuring their lengths. Typical results are given in Table VIII.

Table VIII

Original length in air (cms.)	Length in phenol (cms.)	Contraction (%)	Length in air after washing (cms.)	Contraction (%)
4.420	4.260	3.6	4.425	Nil
5.360	5.195	3.1	5.360	Nil
5.880	5.540	5.8	5.875	Nil

Although length contraction of wool fibres in phenol is much too small to account for the whole of the shrinkage observed with fabrics, its contribution is not negligible. Further, although the fibres return to their original length on being washed in water, length contraction in phenol may play some part in determining the permanent shrinkage of washed, phenol-treated fabrics if there is any relative movement of fibres during phenol treatment and washing.

A first indication that the second factor, lateral swelling of the fibres, might play some part in causing shrinkage of wool fabrics in phenol, was obtained by determining the extent to which the shrinkage of a yarn is dependent on its twist. For this purpose, 10-inch lengths of a 1/48s merino yarn were untwisted in a twist-testing instrument and different, known, amounts of twist were then inserted by hand. Short lengths of these yarns were mounted in stainless steel setting frames, and after their lengths had been measured by means of a travelling microscope, the yarns were slackened and immersed for 15 minutes at 50° C. in a solution having the composition of phenol hydrate. The taut lengths of the yarns were re-measured in the solution and again after 15 minutes' washing in running water, followed by drying. Shrinkage data are given in Table IX.

Table IX

Twist (turns/inch)	Percentage shrinkage	
	In phenol hydrate	After washing
10	10.0	3.7
	11.6	3.2
15	11.4	6.3
	10.2	4.5
20	12.4	5.8
	11.6	8.4
25	13.0	7.5
	17.0	8.8

Like fabric, but unlike single fibres, the phenol-treated yarns show a considerable contraction after being washed and dried, in agreement with the earlier suggestion that relative movement of fibres may take place during the phenol treatment and subsequent washing of fabrics. As the shrinkage of the yarns in phenol increases with the amount of twist inserted, it seemed probable that an important cause of shrinkage is lateral swelling of the fibres. Swelling measurements were therefore undertaken, using lightly pigmented human hair instead of wool, so that the fibres would be clearly visible in the phenol solution.

Single fibres of human hair, which had been purified by extraction with alcohol and ether in a Soxhlet apparatus, followed by washing in distilled water, were mounted between the pairs of clamps of a brass apparatus, which fitted inside an optical cell made of glass. The clamps were so arranged that each fibre could be drawn taut at will, and then rotated bodily about a vertical axis to allow the major and minor axes of the elliptical cross-section to be measured. For this purpose, an image of the fibre was thrown on to a vertical screen by means of a projection microscope, the magnification

being kept constant throughout the whole series of experiments. After measuring the major and minor diameters of each fibre in room air, the glass cell was filled with distilled water and the diameters re-measured at 22° C. The cell was then emptied, dried and re-filled with phenol hydrate, in which the fibres were allowed to stand for 18 hours at 22·2° C. (humidity room). The swelling of the fibres in the solution was then determined at various temperatures, the cell being heated by means of a resistance coil enclosed in a glass tube and immersed in the solution, which was well stirred throughout the experiment. If  $a$  and  $b$  are the major and minor diameters of the fibres, respectively, swelling was calculated as the percentage increase in the value of  $\sqrt{ab}$ , referred to its value in water at 22° C. The results are summarised in Table X, illustrated by Fig. 4.

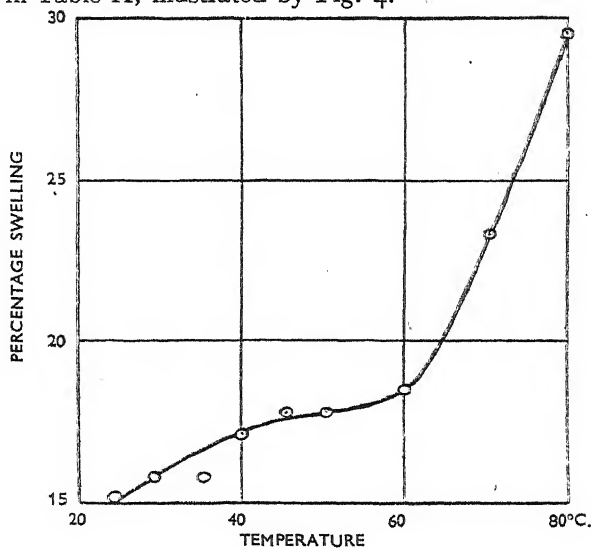


Fig. 4

Table X

Medium	Temperature (° C.)	Fibre 1				Fibre 2	Fibre 3
		$a$	$b$	$\sqrt{ab}$	Swelling (%)	Swelling (%)	Swelling (%)
Room air ...	—	16.9	10.2	13.1	—	—	—
Water ...	22	17.6	12.2	14.6	—	—	—
Phenol hydrate ...	24	21.0	13.4	16.8	15.1	10.7	19.5
" " ...	29	21.3	13.4	16.9	15.8	—	—
" " ...	35	21.4	13.3	16.9	15.8	—	—
" " ...	40	21.8	13.4	17.1	17.1	—	—
" " ...	45	22.0	13.4	17.2	17.8	—	—
" " ...	50	22.0	13.3	17.2	17.8	14.1	22.6
" " ...	60	22.2	13.3	17.3	18.5	—	—
" " ...	70	22.7	14.3	18.0	23.3	—	—
" " ...	80	24.0	14.8	18.9	29.5	20.6	33.6

Since the curves of Figs. 2 and 4 are similar in shape, it seems clear that the shrinkage of wool fabrics in a solution having the composition of phenol hydrate is governed to a large extent by the pronounced lateral swelling of the component fibres, in agreement with the observations on yarns containing different amounts of twist.

An interesting feature of the results for Fibre 1 in Table X is the constancy of the minor diameter  $b$  between 24° and 60° C. This observation was confirmed by further measurements on a fibre from a different supply.

of hair, the procedure being exactly the same as before, except that measurements at different temperatures were commenced half-an-hour after the fibre had been immersed in phenol hydrate at 26.5° C. The results are given in Table XI.

Table XI

Medium	Temperature (° C.)	<i>a</i>	<i>b</i>	$\sqrt{ab}$	Swelling (%)
Water ... ..	22.0	37.0	28.0	32.2	—
Phenol hydrate ... ..	26.5	40.0	30.1	34.6	7.5
" " ... ..	31.0	41.5	30.0	35.3	9.6
" " ... ..	35.0	43.0	30.2	35.9	11.5
" " ... ..	40.0	45.0	30.0	36.8	14.3
" " ... ..	50.3	47.0	30.1	37.6	16.8

On being washed in running water for 18 hours, after the completion of the above measurements, the fibre returned exactly to its original diameter in water at 22.0° C., confirming the suggestion already made that the shrinkage which persists after phenol-treated yarns and fabrics have been washed must be due to relative movement of the component fibres during phenol-treatment and washing.

So far, however, no direct evidence has been obtained in support of the third possibility that part of the shrinkage of wool fabrics in phenol is due to relative movement of the component fibres. If such movement does occur, repeated treatment with phenol should cause a progressive increase in the shrinkage of a fabric, especially the shrinkage permanent to washing. A 2.5 g. (air-dry) pattern of fabric A, on which a 10-cm. square had been marked out in coloured cotton, was therefore immersed in 100 g. phenol for 15 minutes at 80° C. After the pattern had been washed in three changes of water at 35° C., followed by running water for 30 minutes, it was centrifuged and the area of the marked square re-measured. The whole process was carried out four times in succession and shrinkage data are given in Table XII.

Table XII

Number of treatments	Percentage shrinkage in area	
	In phenol	After washing
1	28.8	18.5
2	33.4	27.2
3	35.1	30.4
4	36.2	33.4

In the light of these results, there can be little doubt that the shrinkage of wool fabrics in phenol and phenol-water mixtures is due to length contraction and lateral swelling of the component fibres, accompanied by their movement relative to one another during treatment and subsequent washing. Lateral swelling seems to be the most important of these factors, and since the greatest shrinkage is produced by concentrated aqueous solutions of phenol, it seems clear that the phenol functions as a weak acid. The extent to which wool fabrics can be shrunk by simple immersion in concentrated solutions of other weak acids was therefore examined.

(a) *Formic Acid*.—It is already known<sup>4</sup> that wool fibres undergo pronounced lateral swelling in 98 per cent. formic acid at 22.2° C., and the 90 per cent. formic acid used in the following experiments was found to increase the diameter ( $\sqrt{ab}$ ) of human hair by 16.3 per cent. at 22.2° C., compared with the diameter in water at the same temperature.

The rate at which shrinkage takes place in 90 per cent. formic acid was first examined by immersing each of a number of 2.5 g. (air-dry) patterns



of fabric A, on which 10-cm. squares had been marked out, in 100 ccs. of the solution for a specified time at 50° C., washing in three changes of water at 35° C., followed by running water for 30 minutes, and then re-measuring the areas of the marked squares. Shrinkage data are given in Table XIII.

Table XIII

Time of treatment (minutes)	Percentage shrinkage in area	
	In formic acid	After washing
5	19.0	4.0
10	19.9	5.0
15	20.8	7.9
20	21.7	6.9
25	21.7	9.8

As in the case of phenol, shrinkage takes place extremely quickly, and the influence of the temperature of treatment on the extent of shrinkage was next examined by immersing each of a number of 2.5 g. patterns of fabric A in 100 ccs. of 90 per cent. formic acid for 15 minutes at a specified temperature. After treatment, the patterns were washed in the usual manner and shrinkage data are given in Table XIV.

Table XIV

Temperature of treatment (°C.)	Percentage shrinkage in area	
	In formic acid	After washing
25	19.0	6.0
30	19.0	6.9
40	20.0	7.8
50	19.9	6.9
70	21.7	7.8

Unlike that of phenol, the shrinking effect of formic acid is almost independent of the temperature of treatment, and although formic acid and phenol are generally very similar in their behaviour, phenol is far more effective in causing shrinkage at high temperatures.

(b) *m*-Cresol.—The shrinkage of fabric A in *m*-cresol and a mixture of *m*-cresol and water was examined by treating patterns for 15 minutes at 80° C. in the usual manner, but the time of washing in running water was increased to 2 hours on account of the lower solubility of *m*-cresol. The results are summarised in Table XV.

Table XV

Percentage by weight of water in mixture	Percentage shrinkage in area	
	In mixture	After washing
0	27.6	9.8
10	27.8	14.4

*m*-Cresol is very similar in its behaviour to phenol, and the preceding experiments with phenol, *m*-cresol and formic acid confirm the suggestion that the shrinkage of wool fabrics in such reagents is characteristic of concentrated solutions of weak acids in general. Attention was next turned to the practical application of the shrinkage phenomena.

#### Practical Applications

It is obvious from the results of Table XII, that if a wool fabric were passed at open width through hot phenol and water, alternately, in a succession of tanks fitted with squeeze rollers, rapid and pronounced shrinkage

would be the result. A continuous process of this type might have special advantages with particular types of fabric, especially those in which pronounced shrinkage without the development of cover is desired. In general, however, the difficulty of recovering phenol from the wash water would render the process uneconomic, and attempts were therefore made to fix the primary shrinkage of the fabric in phenol by means of steam. If successful, a method of this type would lend itself very well to the production of crêpes, and the effect of steaming fabric on which phenol hydrate had been printed was therefore examined.

Phenol hydrate was printed in two sets of parallel lines at right angles on a sample of fabric A, the lines being about  $\frac{1}{8}$ -inch wide and  $\frac{1}{2}$ -inch apart. The pattern was then exposed to a current of dry steam at  $117^{\circ}\text{C.}$  for 10 minutes. On removal, it showed a pronounced blister effect, which was permanent to washing in water at  $40^{\circ}\text{C.}$  Equally successful results were obtained when a printed pattern was exposed to steam at  $102^{\circ}\text{C.}$  for 10 minutes, and the lower temperature would be preferred in practice because it leaves the wool almost unaffected as regards strength, whereas degradation is severe at  $117^{\circ}\text{C.}$  Strength measurements were made on strips of fabric, each 12-in.  $\times$   $1\frac{1}{2}$ -in., in which coloured cotton indicator threads had been inserted at a distance of 1-in. from each end. The strips were impregnated with phenol hydrate at room temperature, squeezed between rollers, and then steamed for 10 minutes at  $117^{\circ}$  or  $102^{\circ}\text{C.}$  Ten strips were treated at each temperature, and after being rinsed in water at  $40^{\circ}\text{C.}$  they were exposed for three days, with ten untreated strips, to an atmosphere at 65 per cent. relative humidity and  $22.2^{\circ}\text{C.}$  Determinations of strength and extensibility were carried out under the same conditions, with the strips gripped at the indicator threads, and the results are given in Table XVI.

Table XVI

Pattern	Percentage Shrinkage in area	Breaking Load (kg.)	Extension at Break (%)
Untreated ... ..	—	$9.4 \pm 0.5^*$	$32.1 \pm 1.5^*$
Steamed at $117^{\circ}\text{C.}$ ...	60	$8.6 \pm 1.4^*$	$13.8 \pm 1.9^*$
Steamed at $102^{\circ}\text{C.}$ ...	56	$9.2 \pm 0.6^*$	$28.8 \pm 3.5^*$

\* Average deviation.

Highly satisfactory crêpes can thus be produced by printing wool fabrics with phenol hydrate, which may be thickened with poly-ethyl acrylate or other suitable agents when specially well-defined effects are desired, followed by steaming at  $102^{\circ}\text{C.}$  for 10 minutes. The success of the process seems to depend on the effect of heat in accentuating the shrinking power of phenol, and the action of steam in promoting setting reactions in the fibres of the contracted fabric before the phenol evaporates. As the conditions are obviously rather critical, it is not surprising that no trace of a crêpe effect was obtained when a fabric printed with formic acid was steamed for 10 minutes at  $102^{\circ}\text{C.}$ , for the shrinking effect of formic acid is scarcely affected by rise of temperature, and setting reactions are hindered by strong acids.<sup>8</sup> In the light of this result, it seemed desirable to examine the crêping power of a series of weak acids so as to establish the maximum strength of acid it is permissible to use.

The acids chosen for examination were all phenols—*m*-cresol, phenol, resorcinol, *p*-chlorophenol, 2:4:5-trichlorophenol and 2:4-dichlorophenol. In printing, *m*-cresol was applied without dilution, phenol was used as the hydrate, and the chlorophenols were mixed with  $\frac{1}{2}$ -mol. of water and just sufficient alcohol to give clear liquids at room temperature. Resorcinol, which is already known<sup>6</sup> to give crêpe effects under conditions similar to

those described above, was mixed with 1 mol. of water and the mixture clarified with alcohol. After the patterns had been printed with the various reagents, they were steamed for 10 minutes at 102° C. and then rinsed in water at 40° C. The results are given in Table XVII, which includes values for the dissociation constants of the compounds used.

Table XVII

Reagent	Dissociation constant	Crêpe effect
<i>m</i> -Cresol ... ..	$9.8 \times 10^{-11}$ (25° C.) <sup>7</sup>	Good
Phenol ... ..	$1.09 \times 10^{-10}$ (25° C.) <sup>8</sup>	Good
Resorcinol ... ..	$3.7 - 4.0 \times 10^{-10}$ (18° C.) <sup>9</sup>	Good
<i>p</i> -Chlorophenol ... ..	$6.6 \times 10^{-10}$ (25° C.) <sup>10</sup>	Good
2 : 4 : 5-Trichlorophenol ... ..	$4.3 \times 10^{-9}$ (25° C.) <sup>11</sup>	Slight
2 : 4-Dichlorophenol ... ..	$1.8 \times 10^{-8}$ (25° C.) <sup>10</sup>	Very slight

The dissociation constant of the phenol should obviously not exceed  $1 \times 10^{-9}$  if it is to be really effective in producing crêpe effects and permanent shrinkage under the influence of dry steam. Even when the phenol has a satisfactory dissociation constant, a crêpe effect is not obtained if the fabric to which it is applied contains a strong acid, because the latter inhibits setting reactions. This fact was revealed during the course of an attempt to crêpe a chlorinated fabric. After phenol hydrate had been applied, the fabric was steamed for 10 minutes at 117° C., but no crêpe was obtained. The result was particularly disappointing because crêpe effects in chlorinated wool are likely to possess special value, but the chlorinated fabric was found to be slightly acid (pH 4). When the process was repeated with a second pattern, which had been immersed in 0.25 per cent. sodium carbonate solution for 15 minutes at room temperature, washed in running water for 30 minutes, and then dried, the resulting crêpe was excellent. Crêpe effects can thus be obtained with "unshrinkable" as well as ordinary fabrics, provided they are neutralised before applying a phenol with a dissociation constant less than  $1 \times 10^{-9}$  and steaming at 102° C.

#### SUMMARY

Wool fabrics undergo rapid and pronounced shrinkage when they are immersed in concentrated aqueous solutions of phenol or melted phenol. Shrinkage is complete in 15 minutes and increases in extent with increasing temperature of treatment up to 90° C. at least. When the treated fabric is washed in water, it tends to revert to its original area, but part of the shrinkage—about a third—persists after a 24-hour wash in running water.

Shrinkage appears to be due mainly to the pronounced lateral swelling of wool fibres in concentrated aqueous solutions of phenol, accompanied by a slight length contraction. In addition, there must be some relative movement of the fibres during phenol treatment and washing, because part of the shrinkage of a fabric is permanent to washing, whereas fibres swollen and contracted in phenol revert to their original dimensions when the phenol is removed.

When a fabric is subjected to repeated treatment with hot phenol and water, alternately, almost the whole of the initial shrinkage in phenol can be made permanent to washing, presumably owing to relative movement of the fibres. A process of this type might have special advantages in cases where pronounced shrinkage is desired without the development of cover, but the difficulty of recovering phenol from the wash water seems likely to prevent widespread use of the method.

The primary shrinkage of the fabric in phenol can, however, be made permanent by steaming at 102° C. for 10 minutes. By its heating effect,

the steam accentuates the shrinking action of phenol, and the enhanced shrinkage is fixed by the occurrence of setting reactions in the fibres of the contracted fabric. Setting reactions are, however, inhibited by acid, and when a series of phenols of increasing dissociation constant were examined, it was found that the dissociation constant must not exceed  $1 \times 10^{-9}$  at  $25^{\circ} \text{C}$ . if the primary shrinkage is to be fixed in steam. For the same reason, fabrics which are likely to retain acid from previous processes, e.g. chlorination, must be neutralised before the application of phenol and steaming. It seems likely that the main application of the process will be in the production of wool crêpes by steaming fabrics on which a suitable phenol has been printed.

*Acknowledgment.*—The authors are indebted to the Dyestuffs Division of Imperial Chemical Industries Limited for assistance in this work.

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## 8—A METHOD OF MEASURING THE IRREGULARITY OF CARDED WEB

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### INTRODUCTION

During the course of an investigation dealing primarily with the mechanism of the carding process, it became necessary to devise a method for estimating the regularity of distribution of the constituent fibres in the carded web. Any such method involves two separate problems; first, the removal of a representative sample of the web from the card cylinder in such a manner as to preserve faithfully the fibre distribution originally present, and second, the actual estimation of the regularity of such a sample. For the latter purpose, the photoelectric photometer recently described by one of the authors<sup>1</sup> has been utilised in a simple and straightforward manner. The real novelty of the present method lies in the method used for obtaining and preserving the web samples, which will now be described.

### Sampling Procedure

It was early realised that any attempt to remove the web from the card cylinder unsupported was unlikely to succeed. The web stripped from the final doffer by the stripping comb is such a tenuous structure that even the most delicate manipulation is likely to introduce irregularities not present in the web on the doffer. Further, there was some evidence that the action of the stripping comb itself might modify the regularity of the stripped web. Accordingly, it was decided to fix the fibres in the positions occupied by them when actually on the wires of the card cylinder by applying to the latter a sheet or strip of transparent adhesive material, to which the fibres could stick, and thus withdraw the web sample attached to the transparent support. This method was found to be simple and reliable in practice. The details were as follows:—

The supporting material used was the self-adhesive cellophane tape now available commercially. A width of four inches was found to be suitable for most purposes, and enables samples to be taken either across the cylinder (i.e., parallel to the axis of rotation) or along the circumference, as circumstances may demand. This tape was found to be very uniform, both in thickness and transparency. A length of this material is laid on the surface of the cylinder and held in position by one operator, while a second presses it firmly on to the wires by means of a rubber roller squeegee such as is used for photographic purposes. Alternatively, the strip may be held in a wooden frame curved to fit the surface of the cylinder, which may be steadied with one hand while the roller is applied with the other. In either event, after thoroughly rolling the tape down, it is carefully lifted from the cylinder, working from the backs of the card wires towards the front, i.e., in the direction in which the wires point. In the case of the doffer, from which samples are most generally taken, the web lies almost entirely on the tips of the teeth and is easily lifted clear. When samples are taken from the swifts or workers, it is sometimes advantageous to slip a piece of thin sheet metal with a smooth edge along under the tape as it is lifted from the cylinder, in order to assist in clearing a small proportion of fibres which are entangled in the lower parts of the card wires. It is found that under these conditions the sample obtained is substantially the "working" web, the "fettling" layer remaining practically undisturbed. Having thus removed

the sample from the card cylinder, a second strip of tape can be placed over it, sticky side down, so that the fibres are sandwiched between the two supports and a permanent preparation is obtained. Air bubbles between the strips are readily avoided, since the fibres provide many capillary channels leading to the edge, along which trapped air can escape.

#### Measurement of Regularity

The measurement of regularity of fibre distribution in samples so prepared is a comparatively simple matter. A fixed slit is set up in front of the photoelectric cell of the photometer (*loc. cit.*) and the web sample, additionally mounted between two strips of glass of suitable size, is traversed behind the slit, in a direction at right angles to the optical axis of the photometer, by known amounts. The output reading of the photometer is linearly related to the transparency of the portion of web immediately behind the slit; and is hence inversely proportional to its opacity or density. The size of slit used is governed by the type of irregularity which is being investigated. Thus, if a gradual increase in density from, say, one edge of the card to the other, due possibly to faulty feeding, is being sought, a sample taken across the machine and investigated with a wide slit, perhaps 0.5 in., readings being taken every 2 in. along the sample, will suffice; whereas if short-period irregularities are in question, a narrow slit, say, 0.1 in., and correspondingly closer readings will be employed. As regards length of slit, the limit is set only by the complications which the operator is willing to introduce into the optical system of the photometer. The photo-cell cathode is approximately 1.5 in. long, so that if the slit is illuminated with a parallel beam, a slit length up to this figure can be accommodated without auxiliary optical gear. In practice, a length of 1.0 in. has been found satisfactory for most purposes. No difficulty is found in measuring either thick or thin webs, the sensitivity of the instrument being such that even carded slivers can be measured, though the validity of the results obtained in such a case may be doubtful. No attempt has been made to measure actual average density of a web, say in grams of fibre per square foot, in this manner; such a value, if required, is much more reliably obtained by other methods. The aim has been to measure the variations in density around the mean, and for this purpose it is convenient to set the photometer sensitivity so that the average output reading is approximately the same in all cases. This facilitates visual comparison of the regularity curves, and makes a quantitative estimation of regularity possible. The Coefficient of Variation,

$$\left( \frac{\text{Standard deviation}}{\text{Mean}} \times 100 \right)$$

gives such an estimate, providing it is calculated for sets of readings whose means are not widely different. Such sets are obtained by the above technique.

#### Experimental Results

Figures 1, 2 and 3 show the regularity curves obtained for three web samples, regular, moderately regular, and irregular, respectively. In each case the slit used was 0.1 in. in width and 1.0 in. long, and the sample was moved 0.1 in. between each reading, 90 readings being taken over a 9 in. length of the sample, and the whole of the sample covered by a strip 9 in.  $\times$  1 in. surveyed. In each case this actual strip has been photographed above the corresponding regularity curve, the latter being plotted so that each point on the horizontal axis corresponds to the point in the actual sample which lies vertically above it. The correspondence between the density of the actual sample and the ordinates of the regularity curve is apparent in all cases. In particular, the steady decrease in density from left to right in Fig. 1, which is just apparent in the actual sample, is rendered quite evident in the density curve, by a steady fall in average density.

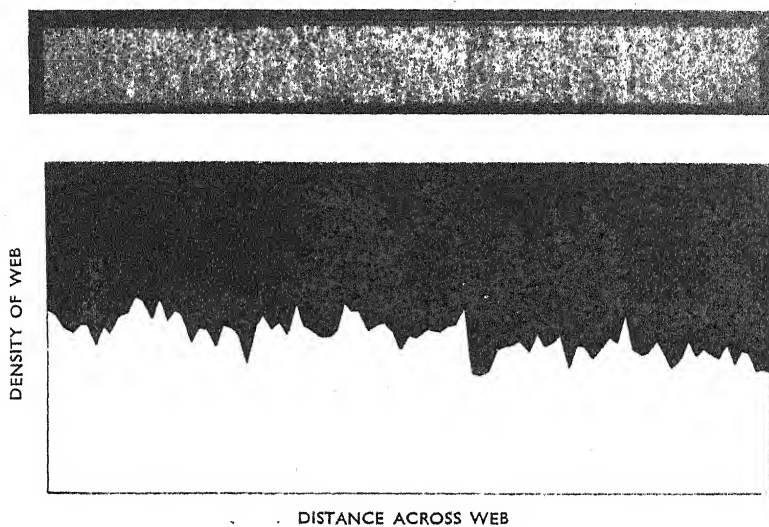


Fig. 1

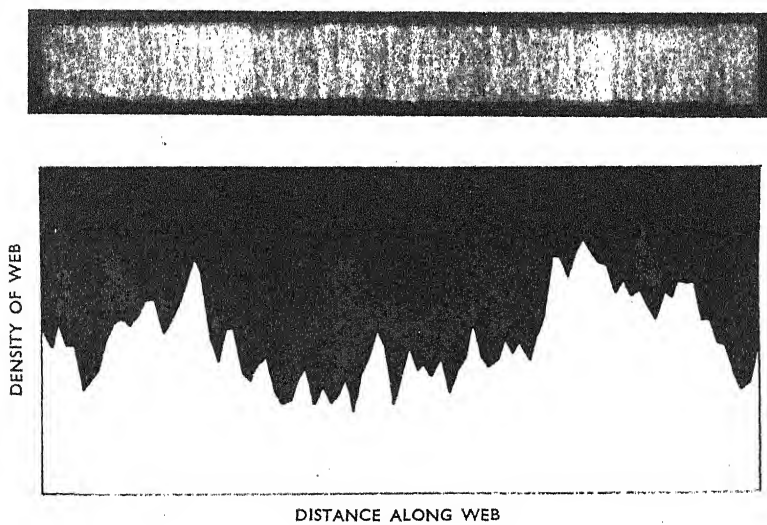


Fig. 2

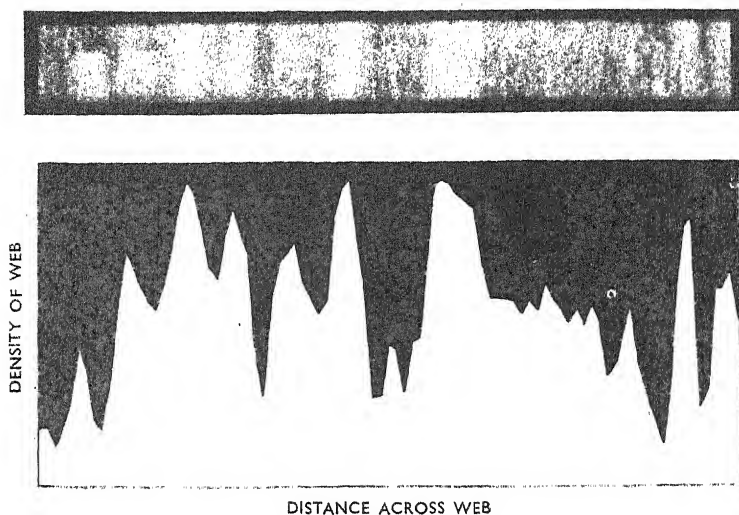


Fig. 3

The standard deviations and coefficients of variation from these curves are given in Table I.

Table I

Web sample	Mean (arbitrary units)	Standard deviation	Coefficient of variation
Regular (Fig. 1) ...	10.38	1.47	14.20%
Mod. Regular (Fig. 2) ...	9.95	2.60	26.1%
Irregular (Fig. 3) ...	8.79	4.38	49.8%

#### SUMMARY

A method for removing and preserving samples of web from the carding engine, and estimating the regularity of fibre distribution in such samples photoelectrically, is described.

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 9—JUTE CELLULOSE AND THE RELATION OF JUTE INCRUSTANTS TO FIBRE AND YARN STRENGTH

By B. P. RIDGE, A. H. LITTLE and J. WHARTON.

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#### SUMMARY

When jute is treated with the chemical reagents employed in textile purification and bleaching processes the lignin, hemicellulose and other incrusting substances are attacked and to some extent removed. The greater the extent of this removal the more is the strength of the jute diminished, particularly when the material is tested in the wet state. Removal of substantially all the lignin with retention of hemicellulose, or of hemicellulose with retention of lignin, results in low wet strength although dry strength is but little affected. Treatments that result in the partial removal of both these incrustants usually reduce both dry and wet strength, although in hot alkaline steeps such as are given in peroxide bleaching, where fibre swelling can occur and there is no pronounced removal of incrustants, dry strength may be increased above the original value owing to the closer setting of fibre on fibre that occurs as a consequence of swelling and subsequent drying. Boiling under moderate pressure with sodium hydroxide solution removes substantially all the hemicellulose but little lignin, whilst treatment with acid chlorite solutions and then neutral sulphite liquor removes the lignin but not the hemicellulose.

The incrustants in jute resemble in their behaviour the starch size on a low-twisted sized cotton yarn and while they themselves have little tensile strength they contribute in marked manner to the strength of the jute by cementing together the ultimate cellulose fibre bundles on which the strength fundamentally depends. In oxidation treatments commonly employed in technical bleaching they appear to have a protective action on the cellulose.

Alkaline hypochlorite has mainly an oxidising, and acid hypochlorite a chlorinating action on jute, and use of the latter in conjunction with a pressure boil with sodium hydroxide and a final oxidation bleach with alkaline hypochlorite promotes attack and removal of lignin and fairly readily allows pure white cellulose to be isolated. If the preliminary chlorinating treatment is not given, more drastic boiling at high pressure is necessary and more than one boil may be required. The characteristics of the jute cellulose are such as to suggest that the product can be used satisfactorily for the manufacture of viscose, cellulose compounds and white papers.

The "browning" of bleached jute that occurs when this material is exposed to sunlight can be prevented only when the conditions of purification are such as to ensure that no lignin remains, and it appears that lignin itself is the product responsible for the browning effect.

#### INTRODUCTION

Raw jute consists of fibres varying in length from about 4 to 8 feet obtained from the outer sheath of the plant stem by a water retting process. The individual fibre is composed of elementary cellulose units of very short

length (roughly of the order 2 to 5 mm.) surrounded and cemented together by a complex structure of hemicellulose, lignin and other plant substances, and owing to the shortness of these cellulose units it is evident that the strength of the fibre (which as in other natural vegetable fibres depends mainly on the cellulose), must be determined largely by the extent to which the incrustants are capable of cementing them together. It is to be expected therefore, that in comparison with cotton, linen and other bast fibres possessing longer cellulose ultimates, jute will be adversely affected to a more marked extent by any chemical or physical action tending to remove the cementing substances or even to loosen their adhesion to the cellulose.

For textile purposes it is often necessary to improve the appearance, softness and other properties of vegetable fibres by bleaching their coloured impurities and removing gums, resins, fats, waxes and non-cellulose materials that may render less efficient the normal operations of chemical or even mechanical processing, but it is usually undesirable to treat the material in such a manner that its loss of weight becomes considerable, and, above all, strength must be conserved to the maximum extent consistent with the obtaining of the other desired effects. Methods for the purification of cotton and linen have already been fully investigated but hitherto no systematic examination has been made of the conditions under which the common textile purifying treatments may be safely applied to jute, or under which the best compromise between loss of strength or weight and lightening of the shade may be achieved.

In the limit, the whole of the incrustants, amounting to about 40 per cent. of the weight of the jute may be removed, and the residual material then consists only of the extremely short fibres of cellulose or modified cellulose. Such highly purified material is necessary if it is intended as a source of cellulose for the manufacture of rayon, cellulose esters or ethers or white papers, but where the original fibre structure must be retained, and the jute is to be employed in spinning and weaving, only comparatively mild treatments may be given.

In the present work an examination has been made of the behaviour of jute yarn and fibre towards reagents that are commonly employed in the purification and bleaching of vegetable fibres and the effects on yarn strength of the progressive removal of the incrusting substances have been investigated. The conditions have also been explored under which yellowing or browning of bleached jute occurs when the material is exposed to light, and the extent to which purification is necessary if such discoloration is to be prevented has been defined. Finally, observations are recorded dealing with the isolation of cellulose from jute and with the suitability of this cellulose for use in the manufacture of rayon or commercial cellulose compounds.

#### **The Action of Alkalies, Oxidising and Reducing Agents on Jute**

The common method of purifying and bleaching most vegetable fibres comprises boiling them with dilute alkali metal hydroxide or carbonate solutions, followed by steeping in dilute mineral acid and treatment with hypochlorite, peroxide or other oxidising agents or with reducing agents, and one or more of these operations may be repeated as required.

The object of the "alkali boil" is efficiently to wet out the material, to saponify or emulsify resins, fats and waxes, and to remove them together with pectin and cell-wall polysaccharides that are soluble in hot dilute solutions of alkalis but not in water. Removal of these substances does not impair the strength of cotton or linen yarns because they are composed of relatively long ultimate cellulose units or cell bundles that overlap to an extent that allows a comparatively large proportion of their individual strength to be realised when they are twisted together. With jute, however, owing to the shortness of the cellulose ultimates on which strength

so much depends, conditions of alkali treatments that are satisfactory for cotton and linen may be expected to have harmful effects because the removal of the cementing substances is capable of loosening the fine fibre structure in such a way that cohesion between the very short cellulose ultimates is weakened.

The acid steep serves to eliminate inorganic and other substances that are soluble, whilst the oxidising treatments are usually essential for the production of bleached effects.

Not only the alkali, but also the oxidising treatments are capable of modifying the incrusting substances. For example, Norman<sup>1</sup> states that "Lignin is curiously unstable towards oxidising agents such as hypochlorites, hydrogen peroxide, permanganate and ozone, and if the reaction is allowed to proceed to completion only the simplest degradation products such as the lower fatty acids and dibasic acids, such as oxalic and succinic can be found." Furthermore such agents are capable of attacking hemicelluloses, and even if lignin and hemicelluloses are not actually removed it is to be expected that such chemical modification will adversely affect their cementing action towards the cellulose ultimates and so cause reduction of strength.

#### The Action of Hot Alkaline Solutions

The conditions of hot alkaline treatment normally employed for vegetable fibres vary in severity from boiling under excess pressure with sodium hydroxide solutions to milder steeping at atmospheric pressure in sodium carbonate solutions either alone or containing a small proportion of an oxidising agent such as peroxide.

The effects of such treatments on the loss of weight and strength and on the lignin content of jute yarn are shown in Table I. It is seen that boiling under excess pressure with a 1 per cent. solution of sodium hydroxide for several hours results in a high loss of weight (23 per cent.) actually twice as great as that occasioned by treatment under atmospheric pressure at a temperature near to the boil with either sodium hydroxide or carbonate solutions. Steeping in a sodium carbonate solution at much lower temperature (65°C.) for two hours gives a much smaller loss as would be expected, but if the carbonate liquid contains also sodium peroxide and silicate the loss realised is not greatly different from that obtained with carbonate alone at the boil. The smallest loss of weight is obtained after a steep in hot water alone.

The percentage losses of lignin under these conditions, based on the original jute after taking into account the corresponding losses of weight, are given in column 3. They are shown to diminish with decreasing severity of treatment, but nevertheless are in all cases comparatively small so that although hot alkaline liquids sometimes cause considerable losses of weight they have relatively little effect in removing lignin. When peroxide is present in sodium carbonate solution (No. 6) some oxidation of non-cellulose constituents may occur but this effect is not pronounced because, for example, the loss of lignin is not markedly higher than when peroxide is absent.

The last columns of this table show the effect of the various treatments on the dry- and wet-strength of the yarns. In no case is any very serious loss of dry strength recorded, but on the other hand the strength of the wet yarns is sometimes considerably reduced.

Comparison of the various properties measured reveals some interesting results. It is seen, for example, that the very mild treatment No. 4 causes very little loss of weight or of lignin and has little effect on either the dry or wet strength of the yarn. The most severe treatment however, with sodium hydroxide under pressure has removed 23 per cent. of weight and although the dry strength of the yarn is not seriously affected,

its wet strength is reduced to a very low value. Under these severe conditions the long chain molecules of the cellulose material must remain to a great extent unaffected in the same way as cotton remains relatively unaffected as a result of technical boiling in the kier, but pressure boiling of this kind favours the removal of the shorter chain polysaccharides, and as the lignin content still remains reasonably high the reduction of wet strength must be due largely to the removal of hemicellulose.

Under the milder conditions of open boiling illustrated by treatments 2 and 3, it is seen that dry strength is also satisfactory and that although the wet strength is reduced, the values are higher than those for the pressure boil. This behaviour is consistent with less complete removal, or modification to a lesser degree, of the cementing material than occurs in pressure boiling. When peroxide is used in what would otherwise be a very mild alkali treatment (No. 6), dry strength is also retained but that there is some action on the cementing material is again indicated by the loss of strength on wetting the yarn.

The effect of a hot water steep (No. 5) is very mild indeed and here the breaking loads should be noted because they are higher than those for the untreated yarn. These higher values may be ascribed in part, though probably not entirely, to mechanical removal of "batching" oil that otherwise acts as a lubricant and promotes fibre slippage. A similar increase is obtained in fact if the oil, fat and wax present is removed from the yarn by extraction with an organic solvent. For example, a hank of the yarn was re-wound, tied twice at opposite points to retain twist, and divided into two portions, one of which was extracted three times with trichlorethylene while the other remained untreated. The loss of weight on extraction was 5 per cent. so that actually more soluble matter was removed than by the hot water steep No. 5. Breaking load measurements were made after conditioning both portions and the results were:

Dry untreated 8.5 lb.	Dry extracted 9.6 lb.
Wet " 8.1 "	Wet " 8.5 "

From the low value for loss of weight (2 per cent.) it is obvious that the hot water treatment has no significant action on hemicellulose or lignin and the wet strength of the treated yarn is high, although not equal to the dry strength.

**Table I**  
**Effect of Hot Alkali Treatment on the Loss of Weight, Lignin Content and Strength of Jute Yarn**

Treatment	% Lignin		% Loss of weight	B.L. lbs.	
	In residual material	Loss on original jute		Dry	Wet
Untreated ... ..	13.8	Nil	Nil	8.1	7.1
Scour.					
1. Pressure boil, 1% NaOH at 20 lb. excess pressure for 6 hours ... ..	13.6	3.3	23.0	7.4	3.3
2. Open boil, 1% NaOH at 90° C. for 6 hours...	—	—	11.0	7.2	4.5
3. Open boil, 10% Na <sub>2</sub> CO <sub>3</sub> on weight for 2 hours ... ..	12.9	2.2	11.0	7.4	4.4
4. Hot steep 7.5% Na <sub>2</sub> CO <sub>3</sub> on weight at 65° C. for 2 hours ... ..	13.3	1.0	4.3	7.8	6.4
5. Water steep, 70° C. for 2 hours ... ..	13.9	Nil	2.0	9.0	7.9
6. Oxidising steep, 10 g/l. Na <sub>2</sub> CO <sub>3</sub> +1 g/l Na <sub>2</sub> O <sub>2</sub> + 8.5 g/l sodium silicate at 65° C. for 2 hours ... ..	13.1	1.9	9.8	8.0	4.7

(Wt. Ratio of liquor to jute in all cases approximately 8:1.)

It follows from the results recorded that important loss of strength occurs only when there is significant removal of incrustants, and even then this loss is realised to a marked extent only when the yarns are tested in the wet state. Wetting an otherwise untreated yarn causes a loss of strength of the order 10 per cent. due probably to the softening effect of water on the individual fibres or their incrustants and to the lubricating action that promotes fibre slippage. Reference to the effect of the non-cellulose impurities on strength is made again in a later section.

#### The Action of Oxidising Agents

##### *Hypochlorite Solutions.*

It is obvious from the chemical structure of the jute fibre and from the variation that occurs in the properties of hypochlorite solutions with change in acidity or alkalinity in the neighbourhood of the neutral point, that very different effects are to be expected according to the  $pH$  of the solutions with which the jute is treated.

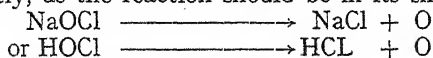
The importance of  $pH$  in the rate of oxidation of cellulose by hypochlorite solutions was abundantly demonstrated several years ago by Clibbens and Ridge<sup>2</sup> who showed the extreme activity of neutral or nearly neutral solutions. Since, however, the jute fibre is composed of lignin and hemicellulose as well as cellulose, and since lignin is very sensitive to both oxidation and chlorination, whilst the polysaccharides other than cellulose are also attacked by hypochlorite it is clear that if undue modification of the structure is to be prevented conditions must be chosen so that both the cellulose and the non-cellulose constituents are affected as little as possible.

It is also fairly common practice in purifying and bleaching other vegetable materials to steep them in a hot solution of an alkali or in an alkaline peroxide liquid after a hypochlorite treatment. Here the effect of the alkaline solutions is to dissolve and remove lignin that has been modified by chlorination and also to remove hemicellulose, and the greater the degree of chlorination and of oxidising attack of these substances the greater is the effect of alkali in promoting their dissolution. The extent to which such liquids have a disintegrating action on jute therefore also depends on the precise conditions of the previous treatment with hypochlorite and for this reason also it is important to ensure that the conditions of use of the hypochlorite solutions are such as to minimise any undesirable effects of subsequent wet processes.

#### The Effect of $pH$ on the Course of the Reactions between Hypochlorite Solutions and Jute

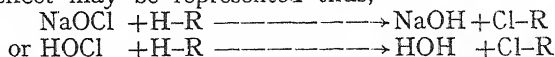
It is already well known that under certain conditions of  $pH$  hypochlorite solutions can exert a chlorinating, and under others, an oxidising action, but no quantitative expression of the extent to which these effects are obtained has yet been given. From what is known of the effects of such solutions on cotton and linen cellulose, oxidation of the cellulose and polysaccharide constituents of jute can no doubt occur, though at varied rates, throughout the  $pH$  range, but, for a given concentration of hypochlorite, chlorination of the lignin or other impurities should be controlled largely by the extent to which hypochlorous acid is present, and should therefore take place to an appreciable extent only when the  $pH$  of the liquor is such as to permit of the existence of this acid in significant proportion, namely within the range about  $pH$  7 to 2<sup>3</sup>.

If hypochlorite acts solely as an oxidising agent, the total salt concentration, measured as chloride, of a solution used in bleaching should not change greatly, as the reaction should be in its simplest terms,



the chlorides remaining in the solution.

When chlorination occurs, chlorine is removed from the solution into the material and the total salt concentration as chloride must fall. For simplicity this effect may be represented thus,



A considerable fall in the total salt concentration as chloride may therefore be taken to indicate chlorination even though oxidation may also occur during the bleaching.

From experiments in which the change in salt concentration was followed when jute yarn was treated under standard conditions, it has been estimated that between pH 11.5 and 9 the fall is approximately one-fifth of the change in hypochlorite concentration and therefore in this range the hypochlorite functions as an oxidising and not to any important extent as a chlorinating agent. Under neutral conditions the corresponding fall was about 46 per cent. and in acid solution (pH about 5) approximately 85 per cent. of the change in hypochlorite concentration. In neutral solutions therefore the hypochlorite functions both as an oxidising and a chlorinating agent, whilst under acid conditions the effect is essentially one of chlorination.

#### The Action on Yarns of Hypochlorite Liquors of Different pH.

In order to examine the effects of hypochlorite liquors of different pH values, hanks of the standard yarn were prepared, wetted out in a cold 0.25 per cent. solution of Calsolene Oil and hydroextracted. They were then entered separately into hypochlorite solutions of the concentration and pH specified below, using a liquor/yarn ratio of 15 : 1, and treated for the stated time. Afterwards they were rinsed, antichlored in a 1 per cent. solution of sodium bisulphite, washed thoroughly and dried.

The liquors employed were prepared by suitable dilution of a concentrated stock solution of bleaching powder or sodium hypochlorite, and were buffered to pH 11 by addition of sodium carbonate, pH 7 by addition of sodium bicarbonate, and pH 4.2 by addition of aluminium sulphate<sup>3</sup>. The concentrations of available chlorine were nominally 3, 5 and 7 g. per litre at the start and treatment was continued for respectively 15, 30 and 60 minutes at room temperature (about 17 to 19°C.)

Table II shows the fall of concentration of available chlorine in the liquors during the treatments.

Table II

	Available Chlorine g/litre			
	Start	After 15 minutes	After 30 minutes	After 60 minutes
Alkaline Hypochlorite ...	3.05 5.10 7.15	1.85 3.33 4.97	1.53 2.56 4.40	1.25 1.81 3.32
Neutral Hypochlorite pH 7 ...	3.03 5.06 7.01	1.06 2.27 2.48	0.71 1.31 1.49	0.28 0.64 0.92
Acid Hypochlorite pH 4.2 ...	2.95 5.11 7.20	1.10 2.95 4.40	1.06 2.35 4.01	0.85 1.50 3.70

From these figures it is evident that the consumption of available chlorine in a given time is least for the alkaline liquors, greatest for neutral ones and intermediate for the acid solutions, although the difference between the consumptions under acid and alkaline conditions is not very pronounced.

In the next Table, III, are recorded the percentage consumptions of chlorine based on the weight of yarn, and it is shown that with the neutral

solutions the percentages are at least 50 per cent. higher than for the other solutions. It is notable in fact that with a neutral liquor of initially 7 g. of available chlorine per litre the jute yarn is seen to have consumed 7 per cent. of its weight of chlorine in 15 minutes and over 9 per cent. in 60 minutes. For comparison it may be stated that the proportion of available chlorine consumed in 30 minutes by brown linen yarns from a neutral hypochlorite solution of original concentration 5 g. per litre, is only about 3 to 3.5 per cent., but it must be remembered that the lignin content of jute (12-14 per cent.) is very much higher than that of linen (3.6 per cent.<sup>19</sup>) and that much of the available chlorine is probably used up in chlorinating and oxidising this substance.

Table III

ACTION OF HYPOCHLORITE SOLUTIONS ON JUTE YARN										
Nominal concentration of Av. Cl. in Liquor		3 g/l.			5 g/l.			7 g/l.		
Time of Treatment		% of Av. Cl. on Jute	B.L. Dry	Lb. Wet	% of Av. Cl. on Jute	B.L. Dry	Lb. Wet	% of Av. Cl. on Jute	B.L. Dry	Lb. Wet
Untreated	...	Nil	8.1	7.1	(Grand mean values)			—	—	—
ALKALINE HYPOCHLORITE										
15 mins.	...	1.8	7.8	—	2.7	7.5	7.6	3.3	7.8	7.4
30	„	2.3	7.7	—	3.8	7.8	6.9	4.1	8.3	7.3
60	„	2.7	7.9	—	4.9	7.9	—	5.8	7.9	6.9
NEUTRAL HYPOCHLORITE										
15 mins.	...	3.0	7.8	7.5	4.2	6.7	6.1	6.8	6.1	5.8
30	„	3.5	7.8	7.3	5.6	7.0	6.4	8.3	6.4	5.8
60	„	4.1	8.3	7.9	6.7	6.5	—	9.2	—	5.8
ACID HYPOCHLORITE										
15 mins.	...	2.8	6.8	—	3.2	3.6	—	4.2	4.6	—
30	„	2.8	6.6	—	4.1	3.2	—	4.8	5.0	—
60	„	3.2	6.9	—	5.4	2.7	—	5.3	1.5	—

In the same Table III, are shown the mean breaking loads of the yarn treated under the three conditions of pH. After the alkaline treatments the strengths of the yarns are good for all concentrations employed, whilst for the neutral conditions they are good for the lowest concentrations (3 g/l) of available chlorine but the loss is greater with increasing concentration. It will be observed that the percentage consumption of available chlorine by the jute is roughly the same for the treatments with neutral hypochlorite of 3 g. per litre concentration as for the corresponding ones with alkaline hypochlorite of 5 g/l concentration, and that the yarn strengths for these two conditions are approximately the same.

A marked fall of strength is to be noted for the treatments with the acid hypochlorite liquors, particularly at the high concentrations, and it is clear therefore that whereas under practical bleaching conditions alkaline solutions may be used without detriment to strength, and neutral liquors are safe in relatively low concentration, the use of acid solutions should be avoided. It is shown later that the undesirable effects of acid hypochlorite are even more pronounced if the treatment is followed by a steep in hot alkaline solutions.

Apart from chlorine consumption and yarn strength, the colour of the treated jute also varies to a marked extent with change of pH of the hypochlorite. Acid solutions lighten the shade to some extent but also impart a yellowish brown tone, neutral liquors give a slightly better colour but the shade is

only lightish brown and the bleaching effect must be considered poor even for the most severe treatment for one hour with a solution of 7 g. of available chlorine per litre. A very marked difference is shown however for the treatments in alkaline solutions where a much lighter shade corresponding to a "half white" is given. The improvement with increasing concentration of available chlorine from 3 to 7 g. per litre is only slight and the bleaching effect is good even at the lowest concentration.

No very close approach to a white can be obtained by means of hypochlorite alone, even with alkaline solutions, and the jute must receive additional treatment if better bleaching is to be obtained.

**Change of pH of Alkaline Hypochlorite Liquors and its Effect on the Properties of the Yarn**

When jute is treated with alkaline hypochlorite liquors, a fall of pH takes place unless precautions are taken by the addition of buffer salts to maintain the alkalinity, and the colour, weight loss and strength of the bleached material may vary according to the pH conditions governing the course of the treatment. For example, if the pH falls from a high value to near to the neutral point the colour of the bleached yarn may be better or worse than that of a sample treated under conditions such that no great change of pH is possible. In order to examine these effects, sample bundles of the jute were wetted out and treated in hypochlorite solutions all of the same original concentration (5 g/l) of available chlorine for 30 to 60 minutes at 15:1 liquor ratio but under different conditions of pH control. They were afterwards antichlored, washed, dried, compared for colour and otherwise tested.

The experimental conditions and the results are recorded in Table IV.

Table IV

Treatment	Time	pH.		% loss of weight	B.L. Lb.		Colour
		Start	End		Dry	Wet	
1. Bleach Powder. Unbuffered.	30 mins. at 16-17° C.	11.1	8.1	6.2	8.0	—	Slightly worse than 2, 3 and 4. All half white colour. No real differences of shade among them. —
2. NaOCl. Unbuffered.	"	11.1	9.0	4.9	7.5	7.1	
3. NaOCl. +0.5 g/l. Na <sub>2</sub> CO <sub>3</sub> .	"	11.2	9.2	5.0	7.9	6.5	
4. NaOCl. +2 g/l. Na <sub>2</sub> CO <sub>3</sub>	"	11.3	9.9	6.1	8.3	7.1	
5. NaOCl. Unbuffered.	60 mins. at 20° C.	11.1	8.8	7.25	8.3	7.2	Better colour than 1 to 4 above. Noticeably better than 5.
6. NaOCl. +10 g/l. Na <sub>2</sub> CO <sub>3</sub> .	"	11.5	10.3	8.6	7.2	6.8	
Original untreated yarn		...	...	...	8.1	7.1	

From the results it is evident that the fall of pH is greatest for the unbuffered bleaching powder solution, which contains only a small reserve of alkali determined largely by the solubility of lime and the temporary hardness of the water used in preparing the solution. With the sodium hypochlorite solutions, which contain a greater reserve of alkali, the fall is relatively less, but even the addition of 10 g. of sodium carbonate per litre fails to maintain the pH at its original value. This effect is to be expected because the buffering effect of sodium carbonate is not particularly good in the neighbourhood of pH 11.5. Nevertheless in trial 6, where this quantity was added the pH did not fall below 10, and the colour of the bleached jute was better than that in any of the other experiments. The effect shown in experiments 5 and 6 of prolonging the time, and probably also of increasing



slightly the temperature of the treatment, in producing better bleaching should be noted. With longer time there is also greater uniformity of colour throughout the material, although at the same time there appears to be a small increase in the loss of weight.

#### Hot Alkaline and Peroxide Bleaching Treatments following Treatment with Hypochlorite

As already stated it is common practice in purifying certain vegetable materials (for example linen) to follow a hypochlorite treatment by a steep in a hot solution of sodium carbonate for the purpose of removing coloured and other impurities rendered soluble in alkali as a result of their modification by the hypochlorite. It is also known, particularly in linen bleaching, that a treatment in hot peroxide solution following a hypochlorite bleach is capable of giving a good white without significant chemical degradation of the material<sup>4, 5</sup>. The effects of such after-treatments on jute are shown by the results in Table V.

Table V  
Breaking Loads (Dry)  
(Mean B.L. of Original Untreated Yarn 8.1 lb.)

Concentration of Av. Cl.					Time. Alkaline	Hypochlorite		
						Alkaline.	Neutral	Acid
Hypochlorite treatment only.								
3 g/l.	...	...	...	...	(mins.)	(lbs.)	(lbs.)	(lbs.)
					15	7.8	7.8	6.8
					30	7.7	7.8	6.6
					60	7.9	8.3	6.9
5 g/l.	...	...	...	...	15	7.5	6.7	3.6
					30	7.8	7.0	3.2
					60	7.9	6.5	2.7
					15	7.8	6.1	4.6
7 g/l.	...	...	..	...	30	8.2	6.4	5.0
					60	7.9	—	1.5
					Hypochlorite followed by hot Sodium Carbonate.			
					3 g/l.	...	...	...
30	7.5	8.7	5.6					
60	7.5	7.25	5.4					
5 g/l.	...	...	...	...				
					30	7.2	6.7	—
					60	7.2	4.5	—
					7 g/l.	...	...	...
30	8.0	6.5						
60	7.8	6.6						
Hypochlorite followed by Peroxide.								
3 g/l.	...	...	...	...	15	6.2	7.6	7.1
					30	6.7	8.0	6.3
					60	7.2	6.9	7.0
					5 g/l.	...	...	...
30	6.7	5.6	5.2					
60	7.1	5.6	4.5					
7 g/l.	...	...	...	...				
					30	7.9	5.9	4.6
					60	7.4	6.6	3.9

Samples of the jute yarns bleached with alkaline neutral and acid hypochlorite as already described were treated further as follows, using again a liquor/yarn ratio of 15 : 1.

- (a) Steeped in 0.5 per cent. solution of sodium carbonate at 60–65°C. for one hour.  
 or (b) Bleached for two hours, at 65°C. in a solution containing sodium peroxide, sodium bicarbonate, and sodium silicate.

Results of tests on the peroxide liquor were,

	Conc. of Peroxide g/l $\text{Na}_2\text{O}_2$	Alkalinity (Normality)
Start ... ..	2.14	0.18 N.
After 30 minutes ... ..	1.95	0.18 N.
After 2 hours ... ..	1.30	0.10 N.

Although the breaking load results are somewhat irregular, it is possible to draw the following significant conclusions, namely,—

- (1) The effects of either a steep in hot sodium carbonate or in dilute alkaline peroxide are small if in the first place the yarn has been treated with alkaline hypochlorite, and this statement obtains for all the concentrations of the hypochlorite solutions examined and for treatments up to one hour's duration.
- (2) After a neutral hypochlorite treatment, the losses of strength are relatively small for the lowest concentration (3 g/l) of available chlorine, but for higher concentrations both the sodium carbonate and peroxide solutions cause appreciable further losses of strength.
- (3) After acid hypochlorite both the sodium carbonate and the peroxide treatments reduce strength very considerably particularly where the higher concentrations of available chlorine and the longer times are concerned. Thus the effect of hot sodium carbonate following a treatment for 1 hour with an acid hypochlorite liquor of 7 g. of available chlorine per litre is so severe that strength measurements can be made only with difficulty.

It follows therefore that whereas after alkaline hypochlorite hot alkaline treatments may be given without serious effect on strength, they must be avoided when an acid solution has been used, but are permissible after neutral hypochlorite provided that the concentration of available chlorine in this solution does not greatly exceed 3 g/l at the stated liquor/yarn ratio.

The sodium carbonate steep following treatment with alkaline hypochlorite causes a further slight improvement in colour with a change from a yellowish to a greyer tone. After neutral hypochlorite it gives no significant improvement but again a slight alteration in tone, whilst after an acid solution the colour, which was already bad, is if anything worse.

A mild peroxide treatment under the conditions stated improves considerably the appearance of yarn previously bleached with alkaline hypochlorite, and after this treatment there is some approach to white.

After neutral hypochlorite there is also some improvement, although under the conditions employed the colour is not as good as that given by the above alkaline sequence, but after acid hypochlorite the effects of the peroxide are still very poor and the yarn still remains brown in colour.

#### **The Effects of an Oxidising Steep and of Subsequent Hypochlorite and Peroxide Treatments.**

The presence of a small proportion of peroxide in a sodium carbonate steeping liquor has a marked effect on the colour of jute and enables better shades to be obtained after subsequent treatments with hypochlorite and peroxide. The effects obtained by combining such a treatment with other bleaching operations are illustrated by the results of the following trials.

A batch of jute yarn was steeped for two hours at 65°C. in a solution containing per litre 9.5 g. of sodium carbonate, 8.5 g. of sodium silicate and 1 g. of sodium peroxide. The colour obtained was light fawn, considerably lighter than when the liquor contains no peroxide. Portions of this material were treated with neutral or alkaline hypochlorite solutions of the concentrations and for the times stated in Table VI, and portions of these samples again were subsequently immersed for one hour at 65°C. in a solution containing per litre 8.5 g. of silicate, 3 g. of sodium peroxide, and the equivalent of sodium bicarbonate (see section on Further Experimental Details).

For comparison also, a further batch of yarn that had received no steep, was treated first with alkaline hypochlorite and then with peroxide under conditions already used for the previous steeped yarns (see No. 9, Table VI).

The liquor/yarn ratios throughout were approximately 15 : 1 and handling was avoided as far as possible until the yarns were dry.

The results obtained are collected in the following Table VI.

Table VI

Treatment	% Loss of Wt.	B.L.		Colour
		Dry	Wet	
1. Original yarn ... ..	—	8.1	7.1	
2. Oxidising steep at 15 : 1 ratio for 2 hours at 65°C.	6.0	8.6	6.7	Slightly lighter than 1.
3. Oxidising steep, Neutral hypochlorite 2 g. Av. Cl/1 20 minutes	7.4	8.4	5.6	Lighter than 2.
4. Oxidising steep, alkaline hypochlorite 2 g. Av. Cl/1, 20 minutes	6.9	8.4	6.0	Lighter than 3 (fair bleach).
5. Oxidising steep, alkaline hypochlorite 3 g. Av. Cl/1, 30 minutes	6.5	9.8	6.7	Lighter than 4.
6. As (3)+peroxide bleach 3 g/l $\text{Na}_2\text{O}_2$ , 6.6 g/l $\text{NaHCO}_3$ , and 8.5 g/l of Silicate	9.8	8.8	1.9	Considerably better than 5—good bleach.
7. As 4 then peroxide bleach as 6 ...	7.0	8.9	4.1	Slightly better and more lustrous than 6.
8. As 5 then peroxide bleach as 6 ...	8.0	9.5	4.2	Very slightly better than 7.
9. No steep, alkaline hypochlorite 3 g. Av. Cl/1, for 30 minutes then peroxide bleach as 6	—	9.5	5.2	Intermediate in colour between 6 and 7.
1A, No. 1, after extraction with Trichlorethylene		8.6		
2A, No. 2, do.		8.8		
5A, No. 5, do.		9.5		

It will be observed that for all the conditions of treatment the losses of weight of the yarns are low, the highest value being 9.8 per cent. for sample No. 6, given the neutral hypochlorite treatment before peroxide, but with this solution chlorination as well as oxidation can occur as already shown. The strengths of the dry yarns must also be regarded as good throughout. It is noticeable that they are in all cases higher than that of the original yarn itself, and with one exception, they tend to be higher after the peroxide stage than after the hypochlorite treatment.

At the end of the table, values are given for certain of the yarns that were extracted with trichlorethylene for the purpose of removing oil that might have acted as a lubricant. It is seen that the breaking load of the untreated yarn No. 1 is raised to some extent as a result of this extraction (from 8.1 to 8.6), but not to a value as high as those for the peroxide bleached yarns. In other words, the increase of strength cannot be ascribed merely to removal of lubricant. On suitably staining the yarns, all fat and wax was seen to be removed from those that had had the final peroxide bleach but not from

those that had received only an alkaline steep or a steep and hypochlorite treatment. It was also noticeable that the peroxide bleached yarns were more compact than the untreated or steeped yarns, and it would seem therefore that the increase of strength observed is to be attributed to an increase in the internal friction in the yarns between the fibres themselves, occasioned by both the removal of lubricant and by closer setting of fibre on fibre after the swelling in the hot solutions and subsequent drying.

When single fibres or short lengths of yarn from unbleached and bleached material were immersed in water it was seen that whilst the former remained almost motionless, the latter showed a lively untwisting effect closely resembling the liveliness of a viscose crepe yarn under the same conditions of treatment. This effect may be taken as evidence that the jute material had been previously dried whilst in a strained, or more closely packed, state. An increase in the twist of the yarn caused by shrinkage of the treated hanks can also increase strength and contribute to this liveliness, but here although the shrinkage was actually greatest for the yarns that had received two hot treatments and showed the highest dry strength (Nos. 6, 7 and 8 of Table VI) the amount of such shrinkage (about 2 per cent.) was very small and its effect in increasing twist could therefore also have been only small.

The values for Nos. 2A and 5A in Table VI are not significantly different from those for the corresponding treated but unextracted yarns 2 and 5, so that here the removal of any residual material soluble in the organic solvent has had no effect in further increasing the strength.

The wet strengths in Table VI show a reduction for each of the successive stages of the wet processing, and this reduction is greatest for the yarns that were submitted to all three stages, namely steep, hypochlorite and peroxide bleach. Even under the careful conditions employed in the trials now summarised the loss of wet strength is considerable and it thus appears that such loss is an unavoidable accompaniment of the bleaching processes. The greater loss attending the peroxide stage is probably due in part to the fact that modification of lignin and hemicellulose by the action of the hypochlorite liquors yields products that are soluble in the hot alkaline peroxide solutions and that damage already latent in the partly bleached jute is realised only after the final hot alkaline treatment. Thus when yarn from samples 3 and 5 of Table VI was further treated for two hours at 65°C. in one case (a) with a peroxide liquor 0.2N in excess alkali and in the other (b) with 0.2N. alkali in the absence of peroxide the following wet strengths were obtained.

	Wet B.L. lb.		or (b) 0.2N Alkali
		then (a) Peroxide 0.2N in Alkali	
Sample 3. Alkali Steep and Neutral hypochlorite	5.6	1.3	2.5
Sample 5. Alkali Steep and Alkaline hypochlorite	6.7	3.25	3.7

From these values it is obvious that treatment with the hot dilute alkali alone reduces the wet strength very considerably although the loss is greater if peroxide is also present. Although the mechanism may not be the same, it may be recalled that latent damage in overbleached rayon and other cellulose textiles is fully realised only after treatment of the material in hot alkaline liquids.<sup>6</sup>

The comments in the last column of Table VI indicate the degree of bleaching to be obtained by the different treatments listed. The colours

of samples 6, 7, 8 and 9 that had received a final peroxide treatment were pale cream and must be considered to represent good bleaching for jute yarns.

Although the three-stage processes in which alkaline hypochlorite was used gave perhaps slightly better results than when a neutral solution was employed in otherwise the same sequence, the differences in colour, strength and loss of weight were not pronounced, so that either sequence may be used satisfactorily under the conditions stated. When no steep was given (Sample 9, Table VI), the bleaching effects of alkaline hypochlorite followed by peroxide were also good.

#### The Importance of Liquor/Yarn Ratio

In other experiments similar conditions were employed but the ratio of liquor to yarn in all the operations was twice that used for the yarns treated as in Table VI. The conditions for the oxidising steep and the peroxide bleach were the same as before and the neutral and alkaline hypochlorite solutions of 3 g. of Av. Cl. per litre were used for 30 minutes. The results of tests on the yarns are given in Table VII.

Table VII

Treatment	Loss of Weight	B.L. Dry	lb. Wet	Colour
1. Oxidising steep only		8.0	4.7	Light brown
2. Oxidising steep, Alk. hypochlorite, Antichlor.	11.4	7.0	4.5	Good colour (yellow)
3. Oxidising steep, Alk. hypochlorite, Peroxide	12.1	8.0	3.4	Good white
4. Oxidising steep, Neutral hypochlorite, Antichlor.	12.5	8.0	3.0	Light brown
5. Oxidising steep, Neutral hypochlorite, Peroxide	25.0	4.4	Too weak to measure	Almost pure white, slightly better than (3)

With this higher ratio the losses of weight are seen to be greater than for the 15 : 1 ratio, and for the sample No. 5 treated with neutral hypochlorite in the intermediate stage the very high value of 25 per cent. was realised. The "dry strengths" are satisfactory except for No. 5 again, for which a serious loss is shown, whilst in the wet state this yarn was extremely weak, owing to the excessive removal of incrustants.

The colour of the yarn No. 2 steeped and treated with alkaline hypochlorite was good, with a yellowish shade, whereas the corresponding yarn No. 4 treated with the neutral solution, was only light brown. After the final peroxide bleach however this order was reversed, the better white being obtained with the sample treated with neutral hypochlorite. This particular yarn was almost pure white.

The corresponding "alkaline hypochlorite" sample No. 3 was only slighter darker in colour than No. 5, and had retained strength satisfactorily, and the inference to be drawn is that if strength is to be conserved, alkaline hypochlorite solutions are to be preferred to neutral ones, in the sequence oxidising steep, hypochlorite, peroxide bleach, when high liquor/yarn ratios are employed.

In the bleaching of cotton materials it is known that good results can be obtained by peroxide treatments without an intermediate stage. The usual two-stage bleach comprises first a steep in a hot solution of sodium carbonate containing a relatively small proportion of peroxide and then a second treatment in an alkaline bath containing more peroxide. Experiments illustrating this method are described below.

Jute yarn was steeped for two hours at 65°C. in a solution containing per litre, 8.5 g. of sodium silicate 1.0 g. of sodium peroxide, and 2.2 g. of sodium bicarbonate. •

It was washed with water, the batch was divided and the various equal portions were treated for two hours at 65°C. in solutions of the same initial concentration of peroxide (about 3 g/l as  $\text{Na}_2\text{O}_2$ ) but of different alkalinity.

Tests on these solutions and on the yarns gave the following results :

Table VIII

Time	Peroxide (g/l $\text{Na}_2\text{O}_2$ )	Alkalinity	B.L. lb.	
			Dry	Wet
1. Start	2.88	Steep only	6.2	3.9
2 hours	1.05	0.21 N. Steep and peroxide	5.8	3.4
2. Start	2.88			
2 hours	1.23	0.15 N. „	6.2	3.4
3. Start	2.84			
2 hours	1.33	0.11 N. „	6.4	4.1
4. Start	2.88			
2 hours	2.13	0.05 N. „	5.6	3.8

It is evident that after the hot steep the peroxide treatments have little further effect on either dry or wet strength but the relatively low values for the latter indicate that the incrustants are modified to a considerable extent. The fall of concentration of peroxide is seen to be greater the higher the concentration of alkali but the variation in shade of the yarns was only small and the material treated with the solution of highest alkalinity was only slightly whiter than that treated with the solution of lowest alkalinity.

#### Chlorine Peroxide and Sodium Chlorite

Until recently little interest has been shown in chlorine peroxide or chlorite solutions, and these substances have been considered more as interesting rare chemicals than as technically useful reagents. Their oxidising and bleaching properties have been known for some years and on the laboratory scale they have been used for a few purposes. For example, Sarkar<sup>7</sup> has mentioned the complete removal of lignin from jute by treatment of the material with chlorine peroxide in the presence of moisture and Speakman<sup>8</sup> has shown that the same product is capable of imparting a non-shrink finish to wool when used in carbon tetrachloride solution. In America, however, attention has been directed towards the technical use of chlorite solutions for textile bleaching purposes and claims have been made in patent specifications and in technical literature that this product is unique among textile bleaching agents because it enables bleaching to be done in acid solution at elevated temperature with no significant attack of cellulose material even if metals are present that commonly are capable of catalytic action.<sup>9</sup>

In the present investigation it has been considered of interest to examine the effects of these reagents and to compare their behaviour with that of some of the other substances employed. The trials made and the conclusions drawn from the results are discussed below.

A small hank of jute yarn previously moistened with water was exposed to excess of chlorine peroxide gas for four hours at 0°, to 7°C. A change in colour to yellowish brown occurred fairly quickly but no significant further lightening of the shade was apparent after 2½ hours. In order to find the extent to which lignin had been modified, the sample was extracted for 1½ hours with an alkaline sulphite solution containing 10 g. of the sodium salt per litre. The loss of weight after this extraction was 16.5 per cent. whilst the lignin content was reduced from 13.8 per cent. to 6.1 per cent. The dry strength, originally 8 lb., was 5.0 lb. and the wet strength too low to be measured.

When chlorine peroxide is passed into water to saturation, a pH below 3 is obtained. Such a solution bleaches only slowly at ordinary tempera-

ture, whilst if the temperature is raised a considerable loss of gas occurs. On the other hand good bleaching is realised if the solution is buffered to  $pH$  5 and the jute is treated near to the boil. The results of experiments made under different conditions with solvent extracted, but otherwise untreated jute yarn are given in Table IX.

Table IX

No.	Treatment	Temp.	Time hrs.	% Loss of wt.	% Lignin Content of residual material	Colour	Strength	
							Dry lb.	Wet lb.
1.	Original yarn	—	—	—	13.8	—	8.1	7.1
	$ClO_2$ 6g/l at $pH$ 3.2, Liq. ratio 20 : 1	0°C. to 6°C.	70	3.1	7.25	Golden Yellow	7.8	6.1
2.	$ClO_2$ 5.4g/l, $pH$ 5.1, Liq. ratio 15 : 1	85°C.	1	3.2	10.2	Fair white	7.9	6.9
3.	As 2 but at	16°C.	24	3.0	11.5	Golden Yellow	8.3	7.9
4.	No. 1 extracted twice with 2% neutral sulphite liquor at (Total loss of weight and lignin content of (4) based on original yarn)	85° to 90°C.	1	9.5	1.7	Pale fawn	8.4	1.2
				12.3	1.5			

It is seen that at  $pH$  5 and 85 C. a fair bleach with low loss of weight may be obtained in one hour, whereas at lower  $pH$  and low temperature only a golden yellow colour is reached after many hours.

The effect of treating sample No. 1 with a neutral sulphite liquor to remove lignin after the  $ClO_2$  treatment is interesting because the total loss of weight after both treatments (12.3 per cent.) is the same as the loss of lignin (13.8—1.5 per cent.) which indicates that substantially no hemicellulose, but only lignin, is thus removed.

The close agreement shown is of course to some extent accidental because the methods employed for determining both lignin and loss of weight are not highly accurate. Moreover the precise significance of the results of lignin determinations is unknown and the material actually weighed as lignin is probably a chemically modified substance rather than true lignin as it exists in the original fibre. Nevertheless the approximate agreement between these values has been substantiated in other experiments and the methods of treatment may be of some analytical importance. It has been observed that when alkaline instead of neutral sulphite liquors are employed higher losses of weight are obtained.

#### Sodium Chlorite

From other work on textile materials it is known that chlorite solutions bleach best at a  $pH$  of about 5 and under boiling or nearly boiling conditions. These conditions were accordingly used in examining the behaviour of chlorite solutions towards jute. A concentrated solution of sodium chlorite previously prepared in the laboratory was suitably diluted with acetic acid-sodium acetate buffer liquid, adjusted to give an initial  $pH$  of 5.2, and samples of jute, previously wetted out in a 0.5 per cent. solution of Calsolene Oil were treated as in Table X. In order to give a direct comparison between  $ClO_2$  and chlorite, further experiments were made in which equivalent solutions of these reagents were buffered to the same  $pH$  (5.1) and samples of jute yarn were treated with them under identical conditions of temperature, time and liquor ratio. The results of these experiments are also included in Table X (see Nos. 5 and 6).

Table X

	Treatment	Temp.	Time	% Loss of wt.	% Lignin content	Colour	Strength Dry lb.	Wet lb.
1.	NaClO <sub>2</sub> 13 g/l, pH 5.2	Boil	45 min.	9.4	9.7	Creamy white	7.3	5.4
2.	(Loss of chlorite during treatment 63 %) As (1) then extracted with 1% NaOH	95°C.	2 hrs.	28.0	5.0	White	Less than 3 lb.	Nil
3.	As (1) then extracted with 2% sulphite pH 7.2	90°C.	2 hrs.	1.2	7.7	Fair white slightly better than 1	7.1	4.3
4.	NaClO <sub>2</sub> , 7.2g/l at pH 5.1 (Loss of Chlorite during treatment 89 %)	85°C.	2 hrs.	6.4	10.8	Fairly good bleach, Cream	7.7	6.4
<i>Direct comparison of ClO<sub>2</sub> and Chlorite at same pH</i>								
5.	NaClO <sub>2</sub> 4.8g/l pH 5.1	85°C.	1 hr.	4.3	14.5	Fair bleach, Cream	7.9	6.7
6.	ClO <sub>2</sub> , 2.8g/l at pH 5.1	85°C.	1 hr.	4.6	14.2	Equal to that of 5	8.1	6.9

From experiments 1 and 4 it is seen that good colours may be obtained without serious loss of weight and strength by bleaching with hot chlorite solutions at pH 5 for comparatively short times.

Experiments 5 and 6 show as would be expected that chlorine peroxide and sodium chlorite solutions of equivalent concentration give identical effects under the same conditions stated. The results of other experiments in Tables IX and X are referred to in the subsequent section.

#### Non-cellulose Impurities and the Strength of Jute Yarns

The experiments with chlorine peroxide and chlorite solutions enable certain conclusions to be drawn regarding the importance of the non-cellulose impurities in contributing to the strength of jute yarns. Thus experiment 4 of Table IX shows that a yarn from which substantially all the lignin has been removed, but which retains practically all its hemicellulose, has a very low wet strength although its dry strength is still high. In experiment No. 1 of Table I, it is shown on the other hand that a yarn that retains most of its lignin but loses its hemicellulose (as shown by the high weight loss of 23 per cent.) also has a low wet strength although again its dry strength is relatively high. Again if No. 3 of Table X is compared with No. 4 of Table IX it is seen that the total losses of weight in the two cases are roughly the same (10 to 12 per cent.) but the latter material which has lost almost all its lignin has a very low wet strength, whilst the former with a much higher lignin content has also a higher wet strength.

If both lignin and hemicellulose are removed completely by careful treatment of jute yarn with acid hypochlorite and then boiling caustic soda under conditions that have but little effect on the cellulose (see Table XI No. 10), the material is reduced to a fibrous mass having no strength at all as yarn. Hence, in order to retain dry strength it is necessary to have present at least part of the non-cellulose incrustants to act as a cementing material between the cellulose ultimates, and apparently it does not matter greatly whether lignin or hemicellulose predominates.

If high wet strength is to be maintained, a considerable proportion of both these incrustants must be present, and as shown by other results in the various tables the greater the extent to which both are retained the higher is the wet strength.



It is a matter of common knowledge that jute yarns become weaker on wetting with water, and in this respect they may be compared with sized soft-twisted cotton yarns which in the dry state have a tensile strength considerably in excess of that of the corresponding unsized yarn. Since the strength of the size film is low, and this film by itself contributes little to the strength of the individual cotton hair, its effect is to increase by its adhesive properties the internal friction existing in the yarn between adjacent and overlapping cotton hairs, thus permitting a greater proportion of their individual strength to be realised than is possible when slippage of their In their work on the effect of humidity on cotton yarn, Pierce and Stephenson<sup>10</sup> showed that under equilibrium conditions above 80 per cent. R.H. starch size rapidly loses its strength and resilience and the strength of the sized yarn falls with further increase of humidity until at 100 per cent, corresponding to saturation of the material it becomes identical with that of the original unsized yarn. Furthermore the extensibility of a dry sized cotton yarn of low twist is much less than that of the corresponding unsized, but with increase of humidity and consequent softening of the size film the extensibility of the sized material increases (in some cases by as much as 30 per cent.) until at its maximum it is identical with that of the unsized yarn. The higher strength of the sized cotton yarn is due to the fact that slippage of the comparatively short cotton hairs, which in unsized yarns is a very important factor in determining tensile strength, is prevented.

In jute yarns the fibres are normally very long compared with cotton hairs, so that fibre slippage is relatively unimportant. On this account for present purposes of comparison a jute yarn may be considered to be composed essentially of the very short cellulose ultimates resembling the hairs of the cotton yarn, surrounded by the hemicellulose, lignin and other incrustants that may be compared with the starch size. As with starch, these incrustants of themselves have relatively little strength. Actually it might be considered more apposite to compare a jute fibre with a cotton yarn, but since the jute fibres in the yarns are very long so that slippage and yarn structure can be ignored, the behaviour of the yarn is governed essentially by that of the individual fibre, and the yarn to yarn comparison is therefore permissible for purposes of illustration.

Barker<sup>11</sup> has recently stated that the torsional rigidity of the wet jute fibre is only one-fifth to one-sixth that of the corresponding dry fibre, and Macmillan<sup>10</sup> has shown that maximum swelling is attained when the moisture regain has reached about 32 per cent. and that then the fibre is in a completely plastic condition. Furthermore, mean extensibility results on dry and wet unbleached jute yarn observed during the course of the present work gave the values, dry 2.05 per cent. and wet 3.3 per cent. and on the same yarn bleached, dry 2.8 per cent. and wet 3.5 per cent. thus revealing a marked increase on wetting the yarn. Hence the effects of water on the starch size and on the jute incrustants are similar.

Brown, Mann and Peirce<sup>12</sup> have shown that an increase in the equilibrium humidity from about 70 per cent. to 100 per cent. has only a small effect on the strength of cotton hairs, although the effect actually observed is one of increase and not decrease of strength, and by analogy it may be argued that no diminution of tensile strength of the cellulose ultimates of jute is produced by wetting the fibres. From these observations it may be postulated that the decrease of strength shown on wetting yarns is due not to weakening of the cellulose ultimates but to a swelling and softening action of the water on the non-cellulose incrustants in the same way as that of a sized cotton yarn is due to softening and loss of resilience of the starch size.

#### The Yellowing of Bleached Jute on Exposure to Light

A well-known disadvantage of partly bleached jute is that on exposure to sunlight it becomes discoloured in a very pronounced manner to a yellow-

ish or brown shade. A similar effect is shown by newspaper, which, since it contains a high proportion of ground wood also has a relatively high percentage of ligneous and other non-cellulose impurities. Pure cellulose as typified by cotton carefully bleached to a low fluidity and copper number is resistant to the discolouring effects of light, and since it has been shown earlier in this paper that bleaching, unless of a very drastic nature, fails to remove much of the non-cellulose impurities of jute it is reasonable to assume that the yellowing of this fibre is connected with its residual non-cellulose constituents and not with the cellulose itself.

In order to examine the effect of the discolouration of jute, the materials were exposed under the same conditions for five hours to the light from a high intensity arc. The intensity of the light on the samples was about 200,000 foot-candles, that is, approximately 20 times the intensity of noon-summer sunlight, whilst the time allowed was roughly equivalent to 75 hours exposure to the standard C.P.A. lamp. All the samples were cooled during the exposure by means of a blast of cold, filtered humidified air.

The first seven samples form a series in which the lignin content of the jute yarn decreases progressively from 13 per cent. to about 2 per cent. and the removal of lignin was effected by various methods comprising mild alkaline steeps, hypochlorite, chlorite and reducing treatments. No. 10 represents jute fibre from which lignin and hemicellulose had been removed as completely as possible by means of acid hypochlorite and sodium hydroxide solution, whilst No. 11 was a cutting of jute-cotton fabric boiled under pressure and bleached with hypochlorite by the usual cotton process. Nos. 14 and 15 were samples of linen yarn bleached to respectively  $3/4$  and  $4/4$  white. They still contained some hemicellulose although their lignin contents, as indicated by qualitative tests, were nil. No. 16 was a fully bleached Egyptian cotton yarn of low fluidity and may be regarded as wholly pure cellulose.

From the last column of Table XI it is seen that samples 1 to 7 all yellowed to marked degree, whilst from visual examination of the exposed portions it was impossible to differentiate among them. In other words there was no decrease in the intensity of the yellowing with decreasing lignin content, and No. 7 with a very low lignin content was as deeply yellowed as the rest.

As expected, the cotton and linen yarns remained unchanged, even though the latter contained residual hemicellulose. The "delignified jute fibre" and the jute-cotton cloth were both unaltered, and while the result was anticipated for the fibre samples in view of the severity of their treatment and their high losses of weight, it was rather surprising to find that the cloth sample did not yellow. Subsequent examination of the jute web revealed however that it had been bleached before being woven into the cloth and this pretreatment combined with the "cotton bleach" was evidently sufficient to remove impurities that would otherwise cause yellowing.

From the results recorded it is seen that ordinary bleaching treatments, even if rather severe, fail to eliminate completely the constituents responsible for the yellowing, and that yellowing occurs when lignin is present even though the residual proportion is very small. Thus No. 8 still showed slight discoloration yet its lignin content was only about 0.1 per cent.

Sample No. 13 represents hemicellulose isolated from bleached wood pulp and washed thoroughly to ensure freedom from chemicals. It contained no lignin. Although it may perhaps differ from the hemicellulose present in jute it is significant that it remained unchanged on exposure and from this result and from that on the linen yarns Nos. 14 and 15 which also contained hemicellulose, it appears that this substance does not contribute to the yellowing. The only samples of jute that remained unaltered

Table XI

No.	Material	Treatment	% Lignin Content	% Loss of wt.	Results of Exposure
1.	Jute Yarn	Oxidising steep	13.1	6	Marked yellowing
2.	" "	Oxidising steep, neutral hypochlorite	11.4	7.5	"
3.	" "	Chlorite 13 G/l at pH 5, 45 min. at boil	9.7	9	"
4.	" "	Oxidising steep, Alkaline hypochlorite, Peroxide and hydrosulphite treatments	9.5	9	"
5.	" "	Oxidising steep, neutral hypochlorite, peroxide	7.9	10	"
6.	" "	Press. boil 1% NaOH, NaOCl. 4g. Av.Cl/l.	2.3		Slightly yellow
7.	" "	ClO <sub>2</sub> solution, 70 hrs. at ord. temperature.	2.0	12	Marked yellowing
8.	" "	Extracted twice with hot (neutral) sulphite liquor Acid hypochlorite (5g. Av. Cl/l) 1% sodium sulphite hot (Twice) followed by 1% NaOH pressure boil	about 0.1		Very slightly yellow, hardly noticeable
9.	" "	Chlorine peroxide and sulphite then press. boil 1% NaOH	Nil		No discolouration
10.	Jute fibre	Delignified with Cl and NaOH	Not detectable	43	"
11.	Jute-cotton cloth	Boiled with NaOH under pressure and bleached with hypochlorite	"	—	"
12.	Bleached hessian cloth	Previously browned by exposure to light and then re-bleached with hypochlorite	—	—	Brown re-developed
13.	Hemicellulose isolated from bleached wood pulp.		Nil	—	No discolouration
14.	Linen yarn	Bleached to 3/4 white	Not detectable	abt. 10%	"
15.	Linen yarn	Bleached to 4/4 white	"	—	"
16.	Egyptian cotton yarn	Bleached to full white	"	6	"
17.	Retted Flax fibre	Unbleached	—	—	Colour lightened
18.	Unretted flax fibre	Unbleached	—	—	"
19.	Coir fibre	Bleached with peroxide	—	—	Yellow
20.	Sisal fibre	Untreated	—	—	"
21.	Cellulose isolated from sisal		Not detectable		No discolouration

were those in which lignin could not be detected and it is concluded that yellowing on exposure to light can be avoided only if the conditions of purification are severe enough to ensure that all lignin has been eliminated.

A necessary accompaniment of such severe treatment is that the jute is reduced essentially to pure cellulose of very short ultimate fibre length and consequently the strength of the treated yarn is very low indeed.

Sample No. 12 was a hessian cloth that had been bleached with peroxide to a very pale cream and then browned by exposure to light. The original cream colour was restored by bleaching the fabric in a dilute solution of sodium hypochlorite and the dry material was afterwards re-exposed under conditions similar to those used for the other samples. It is seen that the discoloration reappeared after this exposure and in some measure the effect therefore appears to be reversible.

In contrast to jute, unbleached retted and unretted flax fibres become lighter on exposure, and this effect is perhaps to be expected in view of the bleaching that occurs on exposure of linen yarns or fabrics to light in the

old established practice of "grassing." Unbleached linen has a lignin content estimated at 3 to 6 per cent<sup>19</sup> and if lignin is the primary cause of yellowing it might be thought that raw flax fibre would become discoloured, but here it is conceivable that both yellowing and bleaching occur and that the latter effect predominates. The chemical treatments normally given to linen materials that are subsequently "grassed" are probably sufficient either to eliminate lignin or to reduce it to a very small proportion and with such materials the exposure effect is presumably one of bleaching only.

Coir, which in its normal state is stated to contain about 30 per cent. of lignin, yellows badly even after a peroxide treatment, whilst sisal fibre with a content of about 6 per cent. also yellows. Lignin-free cellulose isolated from sisal by treatment with acid hypochlorite and not sodium hydroxide solution, however, shows no discoloration.

With the exception of linen (where perhaps the effect may be masked) yellowing occurs with all the fibres examined that contain lignin and it is probable therefore that lignin itself is the constituent of the bast fibres that is directly responsible for the discoloration in the presence of light.

### Jute Cellulose

Fairly pure cellulose may be isolated from jute by methods not involving boiling under pressure with alkali, for example by treating it with chlorine peroxide and then extracting with an alkaline sulphite solution, or by using first an acid hypochlorite treatment and then a hot extraction with alkali or alkaline sulphite followed by bleaching with alkaline hypochlorite or peroxide, but it is advisable to use conditions of pressure boiling with sodium hydroxide if the best effects are to be secured.<sup>18</sup>

Difficulty in obtaining a uniformly pure white cellulose lies mainly in the resistance to attack afforded by the dark root ends of the fibre and by residual fragments of bark. For this reason a chlorinating treatment with acid hypochlorite before boiling the material under pressure has advantages because then the lignin is attacked and disintegrated and the incrustants are more readily removed. If the preliminary acid hypochlorite stage is not employed, and the material contains much bark and dark coloured fibre it is generally impossible to obtain a clean white product by giving a single boil at 20 to 30 lb. pressure and then bleaching with alkaline hypochlorite. Generally more than one boil must be given although better results are obtained by cutting up the jute and by boiling at high pressure (55 lb./sq. in. or over) preferably in a rotary vessel.

Since the incrustants in jute consume alkali in considerable proportion it is necessary to ensure that sufficient is present at the beginning of the boil. For example, batches of red and grey Tossa fibre were treated at 25 : 1 liquor ratio for one hour at pH 4 with hypochlorite solution containing 7 g. of Av.Cl/l, boiled at 20 lb. excess pressure for five hours in a 1 per cent. solution of sodium hydroxide, washed, bleached for one hour with alkaline hypochlorite (5g. of Av.Cl/l) and again washed. The product obtained was only creamy white in colour and still contained dark fibre and bark whilst examination of the liquor at the end of the boil showed that the sodium hydroxide was almost completely consumed and that the initial concentration was therefore too low.

By using the same sequence, but with a 3 per cent. solution of sodium hydroxide, good effects were secured and approximately one third of the

Table XII

Material	Total loss of wt.	% Lignin	% -cellulose	% Ash	Fluidity (0.5% soln.)
Grey Tossa	43	—	94	1.03	9.5
Red "	43	—	92	0.79	10.9
" " (Cut up)	43.3	Not detected	94	0.48	7.7
with additional bi-sulphite extraction	44.4	"	96*	* 0.41	9.1

alkali remained at the end of the boil. Results obtained by this treatment are given below, and it is shown also that a steep in hot bisulphite solution after the acid hypochlorite stage and before the boil is not necessary for the purpose of removing more of the incrustants.

The effects of using more drastic conditions of boiling are shown by the following experiments in which no preliminary acid hypochlorite treatment was given. Here the material employed was an all-jute sacking fabric cut up into roughly 3-inch squares.

Treatment	% Lignin	Fluidity 0.5% soln.	% Loss of wt.	Colour
Boil 1% sodium hydroxide 3 hours at 28 lb. pressure Alk. Hypochlorite 5g. Av.Cl/1 2½ hours	4.4	18.6	about 35	Light brown
As above but 3% solution of sodium hydroxide at 55 lb. pressure	1.4	15.4	50	Fair white

It is seen that with the more severe conditions the lignin content of the residual material is lower, whilst the loss of weight is higher. On the other hand, a fair white instead of only a brown colour is obtained.

From the various figures recorded above it is seen that the loss of weight to be expected in obtaining pure cellulose from raw jute is of the order 40 to 50 per cent., but the  $\alpha$ -cellulose content of the product is high. Values for ash contents are reasonably low and could no doubt be diminished by careful attention to rinsing after the steep in dilute acid that is customary in technical practice after bleaching cellulosic fibres.

The fluidity values for the material boiled after an acid hypochlorite treatment show that the processes employed did not result in undue attack of the cellulose, and if the values are converted to viscosities in centipoises of 1 per cent. solution direct comparison may be made with values recorded by Hebbs<sup>13</sup> for wood pulps suitable for the manufacture of viscose rayon, thus :—

Jute Cellulose from Tossa fibre	Cuprammonium Viscosities (1% Soln.)					
	24	37.2	42.7	55.0	58.9	77.6
	Low Viscosity		Medium Viscosity	High Viscosity		
Wood Pulp from Mill A ...	...	17.5	21.3	27.6		
" " " " C ...	...	10.1	12.0	14.9		

The viscosities of the cellulose products isolated from jute are higher than those for the commercial wood pulps, and judging by this property and the high alpha-cellulose and relatively low ash contents there should be no great difficulty in obtaining jute cellulose suitable for viscose rayon, white papers, and perhaps some kinds of cellulose esters or ethers (see also <sup>18</sup>).

Methods similar to those mentioned above may be used for the isolation of cellulose from other lignified fibres. For example Sisal yields a white material of good quality if the original fibre is boiled for five hours at 55 lb. excess pressure with a 3 per cent. solution of sodium hydroxide at 8 : 1 liquor ratio and is then bleached with alkaline hypochlorite of 5 g. of Av.Cl/1 for about two hours. Coir however, in view of its very high lignin content, requires in addition to these treatments a second boil in 1 per cent. sodium hydroxide solution and a final bleach in a more dilute (3g. of Av.Cl/1) alkaline hypochlorite solution.

#### Material

#### FURTHER EXPERIMENTAL DETAILS

Unless otherwise stated, the materials employed in the experimental work described were 8 lb. warp yarns of fairly dark colour. They were chosen as being of medium bleaching quality and representative of average rather than very good grades.

### Preparation of Solutions

For maintaining hypochlorite solutions substantially at the neutral point  $pH$  7, sodium bicarbonate was added in the proportion 5 to 10 g/l, depending on the concentration of available chlorine in the liquor. For acid solutions the usual acetate buffers were employed or for  $pH$  values of approximately 4.1 aluminium sulphate was added to dilute hypochlorite in the proportion about 8 g/l<sup>3</sup>.

Except for the conditions of varying alkalinity referred to in Table VIII, the peroxide solutions were always approximately 0.20N in excess alkali and (unless otherwise stated) of a peroxide concentration equivalent to about 2.3 g. of sodium peroxide per litre. For these conditions the required amount of sodium peroxide is dissolved in water containing the chemically equivalent proportion of sodium bicarbonate. ( $39 Na_2O_2 \rightarrow 84 NaHCO_3$ , i.e.  $NaHCO_3/Na_2O_2 = 2.2$  approximately), and 8.5 g. of sodium silicate (I.C.I. grade J.8r) per litre is added. Neutralisation of the sodium peroxide to the carbonate stage in this way enables advantage to be taken of its alkalinity. In some cases hydrogen peroxide was employed with the necessary higher concentration of added sodium carbonate.

Solutions for the oxidising steep were prepared similarly from sodium peroxide, bicarbonate and silicate, or with hydrogen peroxide, and differed from the corresponding bleach liquors only in their concentration of peroxide (1g. of  $Na_2O_2$  instead of about 2.9 g/l).

In order to increase the stability of the peroxide solutions, magnesium sulphate in the proportion 0.25 g/l was usually added.

Solutions of chlorine peroxide were prepared by the method described by Doree<sup>14</sup> using potassium chlorate, oxalic acid and sulphuric acid, whilst chlorite solutions were subsequently obtained from them in known manner.

### Testing

#### *Lignin Content*

For the determination of lignin content the sulphuric acid method was employed essentially as described by Shorger<sup>15</sup>. The cut-up material was first extracted with an alcohol-benzene solution and 2 g. samples were treated with 72 per cent. sulphuric acid for 18 hours to isolate the lignin. Additional preliminary extractions first with hot water and then with 1 per cent. hydrochloric acid as recommended by Phillips and Goss<sup>16</sup> were not given. Since insufficient information is so far available about the constitution of lignin itself and the effects upon this substance of the various methods of isolation and purification that have hitherto been proposed, all methods of determination must be considered to be to some extent arbitrary and liable to error. The method now used, however, is analytically convenient and at least allows for progressive removal of lignin to be followed in such a way as to show how the content is affected by the various treatments given.

If the bulky flocculent precipitate of lignin obtained after the extraction of the jute material with sulphuric acid in this method of estimation is treated with dilute (N/25) sodium hypochlorite solution the lignin is readily attacked and dissolved, and it is usually found that a small residue of white fibrous cellulose remains. With both unbleached and moderately well bleached jute the amount is approximately 0.5 per cent. on the weight of the original untreated yarn.

#### *Loss of Weight*

In assessing loss of weight, the samples were carefully conditioned before and after the chemical treatment in an atmosphere of 64-65 per cent. R.H., and at 18-19°C., and were then weighed on a sensitive balance. Check weighings after further conditioning were made when necessary to ensure that equilibrium had been reached.

#### *Assessment of Chemical Damage*

In assessing damage to the jute yarns resulting from the chemical treatments given, reliance has been placed on determinations of tensile strength.

Chemical methods such as the fluidity in cuprammonium, solubility number or copper number, give no simple relations for jute that enable the degree of chemical degradation to be determined because these tests apply substantially to cellulose or modified cellulose. Even well bleached jute, however, contains, besides its cellulose, a considerable proportion of hemicellulose and lignin, and these impurities interfere in the tests or in their interpretation. If all the non-cellulose impurities are carefully removed, the methods may be employed in the usual way for assessing the damage to the cellulose itself, but where the exact proportion of cellulose in any sample of jute taken for examination is unknown, separate determinations of this proportion are necessary before the test results can be interpreted in the light of their known behaviour with cellulose itself.

Boiling with caustic soda solution, which is recommended<sup>6</sup> before determination on cotton and other cellulose materials, does not enable satisfactory fluidity results to be obtained with jute because (as shown in Table I) it fails to remove the lignin, and not only does this lignin "dilute" the cellulose to an unknown extent but it remains insoluble in the cuprammonium liquid and may interfere with the normal determinations of viscosity. The lignin and other non-cellulose impurities already possess reducing properties so that in the copper number determination a high value may be due to residual non-cellulose impurities or to chemical attack of the cellulose itself or to both, and the effect on the cellulose cannot be accurately assessed until that due to the impurities is known or has been avoided.

In attempts to determine whether bleaching treatments cause undue attack of the cellulose, the following additional experiments were made.

Samples of unbleached and bleached jute yarn, previously cut up into short lengths, were treated at 50 : 1 liquor ratio for 30 minutes in a hypochlorite solution of 5 g. Av.Cl/1 at pH 4.5, filtered, washed and antichlored. They were then boiled under reflux with 2 per cent. sodium hydroxide solution, acidified and washed. The resulting white fibre was dried to constant weight in a desiccator over sulphuric acid and used for fluidity measurements on 0.5 per cent. solutions in B.C.I.R.A. standard cuprammonium. The following results were obtained :

Exp. No.	Sample of Cellulose from	% Loss of wt.	Mean Fluidity
1.	Untreated jute	43	11.8
2.	Jute yarn bleached by the sequence oxidising steep, 3g Av.Cl/1 alkaline hypochlorite, peroxide	37	12.3
3.	As 2, but with 2g. Av.Cl/1 neutral instead of alkaline hypochlorite	42	12.8

From these values it is evident that the bleaching treatments given, which correspond to those already described in an earlier section, have only a slight effect in increasing the fluidity, and damage to the jute cellulose itself resulting from such bleaching is, therefore, small. Hence in bleaching processes the losses of strength that are encountered appear to be due much more to attack of the non-cellulose constituents of the jute than to attack of the cellulose, and the incrustants can be regarded as having a protective action towards the cellulose whilst they themselves are degraded.

From preliminary experiments it seems likely that more satisfactory separation of cellulose from the other constituents of jute can be made by attacking the lignin with a solution of chlorine peroxide and then removing the modified lignin and the hemicellulose by sulphite and alkaline treatments. By this method less chemical damage to the cellulose occurs than when acid hypochlorite is employed. After such treatment the cuprammonium fluidity of jute cellulose has been estimated to be about 5 to 6 units but further work on the method is necessary before reliance can be placed on such results.

*Breaking Loads*

Strength tests were made on a standard Goodbrand Single Thread Tester after conditioning the yarns at 65 per cent. R.H. and 18 to 19°C. The length of the specimens between grips was not less than 10 inches. In some cases the cut-skein method<sup>17</sup> was used for preparation of the specimens actually employed in testing, the skeins being taken from hanks chosen at random from the main batch of yarns. One portion, or more, of the cut skeins was reserved as original untreated yarn, the remaining portions were submitted to the chemical treatment, and all sets were afterwards tested. For the main bulk of yarn used, grand means for the dry and wet strengths of the original unprocessed yarn were obtained from the results of hundreds of breaks.

In determining the dry strength of the original yarns, the test specimens were first wetted thoroughly with water to remove latent strain and to render the yarns more strictly comparable with the corresponding chemically treated ones, then dried and conditioned. Wet strengths were determined in the usual way by wetting the threads completely in water and keeping them wet during the testing.

Owing to the high variability of jute yarns, which would necessitate an inordinate amount of testing if mean values of great accuracy were to be obtained, no precise significance attaches to small differences between values in the Tables, and the recording of standard deviations has been considered unnecessary since only general and obvious deductions have been made regarding the effects on strength of the various treatments given.

As an example, however, standard deviations have been calculated for the yarns from one experiment in which, of two test bundles obtained by the cut skein method from one and the same re-wound hank of unbleached jute yarn, one bundle was wetted and redried before testing whilst the second remained untreated. The results were as follows:—

		Untreated	Wetted and redried
Mean of 100 breaks	... ..	7.70 lb.	7.88 lb.
Standard Deviation	... ..	1.07 „	1.13 „
Standard Error	... ..	0.107 „	0.113 „

Taking differences greater than twice the standard error of the means as being statistically significant, it is found that the difference between the mean breaking loads is in this case not significant.

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 10—WEAK PLACES IN COTTON FABRICS

An effect produced by defective conditions during loom stoppage.

By FRANK KENDALL

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During ordinary commercial routine testing of textile fabrics, particularly tests for tensile strength, the operator is usually concerned only with the results recorded by the machine, and, apart from obvious jaw breaks and tears, little or no attention is paid to the manner in which the rupture of the fabric takes place. In fact, with certain types of apparatus in common use, it is not possible for one person to operate the machine and observe the reactions of the test sample at the same time.

The writer having been concerned more with research problems than with mere routine testing, has paid attention to this aspect of testing and it has been the customary duty of the operator to notice the behaviour of all the test samples whilst undergoing strain. The same strict supervision obtains whether the tests are being made for research purposes or for Government routine testing. It is due to this fact that the existence of a most pernicious and widespread defect has been discovered which is being created daily in many factories producing cotton fabrics.

This defect takes the form of a weakness warp way in narrow bands across the full width of the fabric, the loss in strength at these positions often being so high as 40 per cent. of the normal fabric strength. It is all the more pernicious in that, with a large variety of fabrics, it is not easily seen even when its existence is suspected or known, and, in all cases up to now, it has passed the normal commercial examination to which fabric is subjected.

Manufacturers will realise the serious nature of such a state of affairs, particularly when these fabrics are required for Service use where a breakdown in performance may have very serious consequences.

Fortunately it can be obviated quite easily and without additional cost to the manufacturer, and below is given a brief description of the cause, and the method of putting a stop to its continuance, or at least of reducing the effect to a negligible quantity.

The defect is produced by leaving the shafts in an open position whilst the loom is standing. Whilst the loom is in this position the threads forming either the top shed or the bottom shed are under greater strain than those forming the opposite shed. This difference in strain is of course greater or less according to the "setting-up" of the loom. The threads under strain

are thus elongated, and when the loom is once more set into motion, these elongated threads do not have any share in setting the warp beam into motion, thus the whole weight of the warp beam is brought to bear on the unstretched threads which then weave into the fabric under excessive tension until the balance is restored. This may be from an eighth to half an inch according to type of fabric and loom setting. It will readily be appreciated that, in the case of a plain weave, the unstretched threads have to bear double their normal weaving tension. Thus a narrow band is produced across the fabric in which alternate threads are very tight and the complementary threads are very slack, so that any strain that is brought to bear warp way on this portion of the fabric is not borne equally by all the threads. A weak place is the result.

Before leaving the loom to stand at week-ends, overnight, at lunch times or during any other break, the shafts should be brought together at the neutral position.

The value of this point is illustrated by the appended results of a number of experiments which have been carried out by several manufacturers who have co-operated with us in order to provide sufficient evidence to convince the trade and, at the same time, to satisfy themselves as to the seriousness of the defect. Most of these experiments have been made on Government Service fabrics.

TENSILE STRENGTH TESTS (warp way only)

Size of sample tested : 7 ins. between the jaws × 2 ins. wide

These test results represent the tensile strength warp way on strips of fabric including a standing place.

Those marked (N) are the normal portions of the fabric and those marked (S) are the portions of the test strips including the standing places.

Where three lots of figures are given in the order (N) (S) (N), the (N) figures represent the normal fabric before and after the standing place, respectively.

All comparisons of (N) and (S) figures are along the same warp threads as illustrated in Fig. 2.

MANUFACTURER No. 1

Type of Fabric	Position of shafts and period of standing	Strength in lbs. Test results	Mean	Loss
16 $\frac{3}{4}$ oz. Cotton Duck <i>Loom A.</i>	Open Week-end	(N) 297, 320, 330, 338, 310 (S) 241, 249, 228, 215, 237	319 234	27%
16 $\frac{3}{4}$ oz. Cotton Duck <i>Loom B.</i>	Open Lunch-time	(N) 338, 358, 345, 352, 356 (S) 268, 275, 247, 254, 251	350 259	26%
16 $\frac{3}{4}$ oz. Cotton Duck <i>Loom B.</i>	Open Overnight	(N) 356, 320, 353, 364, 351 (S) 224, 232, 218, 247, 233	349 231	34%
16 $\frac{3}{4}$ oz. Cotton Duck <i>Loom B.</i>	Closed Overnight	(N) 341, 338, 309, 344, 320 (S) 316, 333, 327, 294, 322	330 318	4%

MANUFACTURER No. 2

16 $\frac{3}{4}$ oz. Cotton Duck	Open Week-end	(N) 352, 364, 358, 360, 362 (S) 265, 213, 246, 246, 239 (N) 340, 370, 360, 369, 380	359 242 364	33%
16 $\frac{3}{4}$ oz. Cotton Duck	Closed Week-end	(N) 345, 342, 357, 356, 340 (S) 333, 307, 327, 302, 316 (N) 321, 355, 366, 377, 374	348 317 359	10%

Type of Fabric	Position of shafts and period of standing	Strength in lbs. Test results	Mean	Loss
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## MANUFACTURER No. 3

Balloon type Cotton Cambric 1st experiment	Open Week-end	(N) 125, 119, 119, 128, 107 (S) 72, 67, 68, 69, 68	120 69	42½%
Fabric similar type to the above. 2nd experiment.	Open Week-end	(N) 110, 113, 111, 114, 107 (S) 69, 69, 66, 64, 66 (N) 110, 109, 109, 113, 109	111 67 110	39%
	Closed Week-end	(N) 120, 108, 109, 104, 122 (S) 105, 107, 111, 110, 98 (N) 120, 115, 118, 117, 115	113 106 117	8%

## MANUFACTURER No. 4

16¾ oz. Cotton Duck	Open Week-end	(N) 386, 408, 366, 371, 383 (S) 267, 260, 286, 253, 273 (N) 376, 400, 346, 380, 360	383 268 372	29%
Cotton Sheeting.	Open Week-end	(N) 129, 127, 123, 130, 124 (S) 107, 105, 93, 105, 100 (N) 114, 123, 112, 121, 121	127 102 118	17%
Cotton Cambric.	Open Week-end	(N) 101, 110, 113, 109, 109 (S) 94, 96, 91, 95, 95 (N) 112, 110, 113, 106, 110	108 94 110	14%
Cotton Poplin.	Open Week-end	(N) 203, 213, 210, 220, 213 (S) 172, 170, 184, 178, 166 (N) 213, 211, 210, 215, 211	212 174 212	18%

## TESTS MADE BY MANUFACTURER (at his mill)

16¾ oz. Cotton Canvas	Closed Week-end	(S) 379, 445, 398, 395	404	Difference
* 16¾ oz. Cotton Canvas	Open Week-end	(S) 308, 312, 323, 296	310	23%

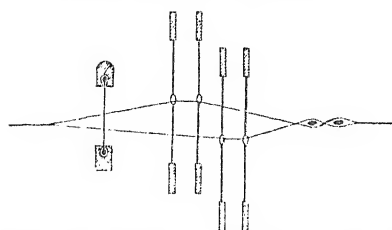
\* These two series of tests were made on fabric of the same quality but from two different looms. No tests were made on normal fabric clear of standing places.

## MANUFACTURER No. 5

Coloured Striped Cotton Poplin Shirting	Closed Week-end	(N) 160, 173, 155, 159, 164 (S) 153, 158, 151, 156, 146 (N) 159, 167, 146, 167, 165	162 153 161	Loss 5%
	Open Week-end	(N) 162, 166, 174, 172, 167 (S) 135, 132, 140, 136, 120 (N) 161, 160, 161, 174, 170	168 133 165	20%

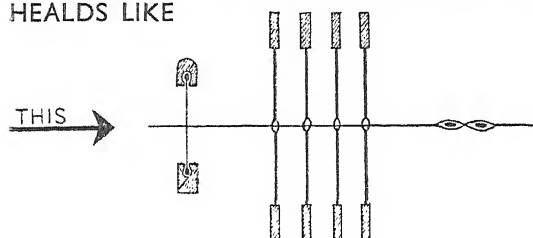
These experiments are in themselves sufficient evidence to show that the practice of leaving the shafts in the open position when the loom is standing is one that should be discontinued, and although the exact relative position of the shafts which would give an exactly equal balance of tension may be a little off the closed position and vary between one loom and another, due to lease rod positions, it is abundantly clear that the simple precaution of bringing the shafts to the closed position is usually sufficient to ensure that, from a practical commercial point of view, the defect is overcome. Where this is not sufficiently effective, a releasing of the warp beam tension will be required.

One of the manufacturers, whose experiments have been cited, after satisfying himself that our statements were well founded, had a number of cards printed which clearly illustrate the necessary precaution, and issued them to all his weavers. A reproduction of this card is given below.



**DON'T LEAVE YOUR HEALDS  
OPEN LIKE THIS! IT MAKES  
VERY WEAK PLACES IN THE  
FABRIC.**

**AT LUNCH TIME, NIGHT, WEEK-END AND AT ALL TIMES LEAVE  
HEALDS LIKE**



**STRAIGHT HEALDS  
SAVE  
FABRIC STRENGTH**

In order to illustrate the form of the defect as it appears in the fabric, a sketched impression both of the surface and warp cross section is appended (see Fig. 1). From this it will be seen how alternate ends are tight and slack, varying to a considerable degree according to respective loom conditions.

A further sketch (Fig. 2) is also given, showing strips of fabric which have been subjected to tensile strength tests. This illustrates how the ruptures all fall in a straight line across the defective bar, whereas in the normal part of the fabric, the breaks occur at random positions and usually at an angle.

It has been possible, with a heavy cotton duck containing the defect in a severe form, to stop the testing machine at the first sign of rupture and to obtain a test piece showing alternate ends broken with the complementary ends intact.

It is hoped that this article will be of interest to all cotton manufacturers and result in preventing the continuation of this unnecessary defect.

Before concluding it is desired to draw attention to another defect which reduces the *general* strength of the fabric to an alarming extent. Although its existence has not been found to be widespread it should not be passed over without mention. This has occurred where, for reasons of convenience, two warp beams have been employed and a general unbalanced tension has been produced between the two sets of warp. This gives an all-over effect similar to the small bars which are the subject of this article, and this matter is mentioned as a warning that fabrics for Service use are not likely to meet specification standards when manufactured in this manner. It also opens up an avenue for research into the making of warps from back beams for if the maximum strength from any given yarn is to be obtained, the balance of tension between all the back beams is of paramount importance.

Figure 3 illustrates how such fabrics break under strain.

Thanks are due to those manufacturers who have been so helpful in producing samples according to suggestions made, and also to my assistants who have diligently helped in this research.

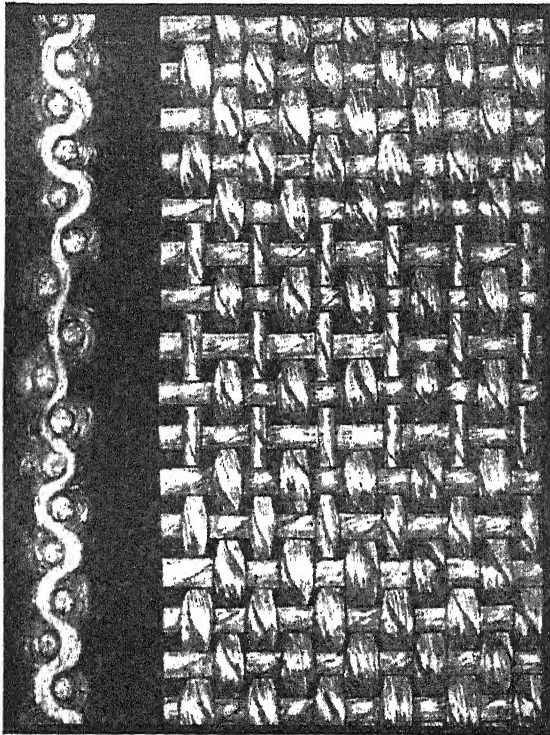


Fig. 1. Reproduction of sketch illustrating plan and warp way cross section of fabric containing standing place with shafts left open.

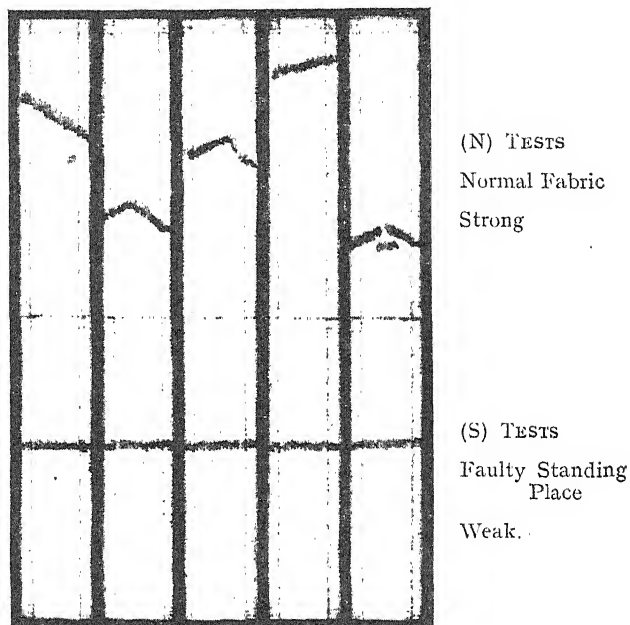


Fig. 2. Sketch illustrating tensile strength test strips of fabric containing standing place with shafts open. Where the defect occurs, the ruptures all take place along one line, whereas in the normal part they fall in random positions.

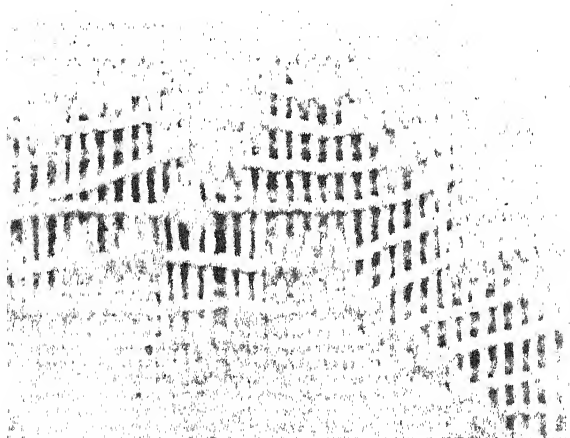


Fig. 3. Micrograph of tensile strength rupture of fabric made from two warp beams at different tensions. Alternate ends only are ruptured.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 11—THE STRUCTURE OF CELLULOSIC RAYONS. Part I. THE NON-DEGRADATIVE ACETYLATION AND DEACETYLATION OF CELLULOSE AND SECONDARY CELLULOSE ACETATE

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#### I. INTRODUCTION AND SUMMARY

The present paper is intended to be the first of a series describing an experimental study of the structure of cellulosic rayons, with particular reference to the chain length (degree of polymerisation) and chain length distribution of their molecules. Cellulose acetate rayons were the first to be examined, and difficulties soon arose owing to the fact that many of them differed slightly in acetic acid yield. It therefore became important to have available methods that could be used to change the degree of acetylation of a cellulose acetate without changing its degree of polymerisation, i.e., without causing any degradation. The use of such methods would enable materials of slightly different acetic acid yield to be compared with greater accuracy, either by bringing them all to the same acetic acid yield, or by studying the behaviour of a series of samples differing *only* in acetic acid yield, so that its effect could be eliminated from the comparison. With the extension of the work to the regenerated cellulose rayons the need for such methods became even more imperative, because it proved impracticable to use solutions of cellulose in the ordinary cellulose solvents for all the purposes of the investigation, and conversion to acetate by a non-degradative process would permit the application of methods similar to those developed for acetate rayon.

Most of the literature on methods of acetylation has been concerned with developments of the processes used in industry for the large-scale production of cellulose acetate, but as these generally make use of acids or acid-producing catalysts in the pre-treatments and the acetylation process they need not be considered here on account of the degradation involved. The methods to be discussed chiefly employ a mild catalyst such as pyridine with acetic anhydride as the acetylating agent. Zemplén and László<sup>1</sup> used a mixture of pyridine, chloroform, and the particular chloride for preparing glucose and cellobiose esters of higher fatty acids; Behrend and Roth<sup>2</sup> used acetic anhydride and pyridine for acetylating glucose; and Hess and Messmer<sup>3</sup> extended this method to the esters of higher fatty acids. Cellulose was esterified with acid chlorides of higher fatty acids in mixtures of pyridine and benzene by Grün and Wittka<sup>4</sup>, Kita and his collaborators<sup>5</sup>, and Pringsheim, Laland and Ward<sup>6</sup>; and with quinoline as catalyst by Karrer and Zega<sup>7</sup>. In these methods the acetylation was generally accomplished by refluxing the cellulose with the reagents for several hours.

The desirability of swelling the cellulose before acetylation was stressed by Elöd and Schmid-Bielenberg<sup>8</sup>; Hess and Ljubitsch<sup>9</sup> had previously used a swelling treatment in dilute sodium hydroxide solution, this being subsequently replaced by the acetylating medium pyridine and acetic anhydride, and the acetylation continued for about 40 days at a temperature below 70° C. The resulting triacetates were insoluble in organic liquids, and the opinion was expressed that the method reduced degradation to a minimum. Staudinger and Eilers<sup>10</sup> criticised the use of the usual acid catalysts, and found<sup>a</sup> by employing a method similar to that of Hess that

triacetates from rayons were soluble in certain organic solvents and were not degraded, whilst triacetates from cotton or wood-pulp would do no more than swell in the solvents. More recently Staudinger and Daumiller<sup>11</sup> have made extensive use of this method of acetylation, and after hydrolysing the triacetates found no change in the degree of polymerisation as indicated by viscosity measurements.

Much of the recent work, with, however, little reference to the possible occurrence of degradation, has been done by Shettle and his co-workers<sup>12</sup>. In this work pyridine was always used as catalyst in preference to either quinoline or dimethylaniline, and, as acetylating agent, the acid chloride was generally used in the presence of benzene. The extent of the esterification was found to decrease in the order acetate, benzoate, palmitate, and stearate, and raw linters acetylated more easily than mercerised cotton, which itself acetylated more easily than viscose rayon. In Shettle's most recent publication<sup>13</sup> it is stated that a mixture of acetic anhydride and pyridine is the best acetylating agent, and the presence of benzene, chloroform, or carbon tetrachloride is undesirable.

The complete acetylation of technical secondary cellulose acetate has been discussed by Bernoulli, Schenk and Hagenbuch<sup>14</sup>, and by Staudinger and Daumiller<sup>11</sup>, who have stated that at room temperature aqueous pyridine and acetic anhydride quickly form the triacetate.

In the present paper several factors affecting the acetylation of secondary acetate and regenerated cellulose rayons by means of acetic anhydride in the presence of pyridine are considered. It is shown that the rayons are not degraded when this method of acetylation is employed, and the dependence of solubility on the degree of esterification is briefly discussed. A non-degradative method of hydrolysing secondary cellulose acetates while in solution, in order to eliminate non-random effects due to a heterogeneous process, or to samples having different molecular orientations, is also given.

## II. EXPERIMENTAL METHODS

### (a) Method of Acetylation

Partial acetylation of cellulose proceeding in a heterogeneous system always results in a non-random distribution of acetyl groups, and so makes any theoretical treatment difficult. It is therefore desirable to acetylate in a homogeneous system, especially when intermediate degrees of acetylation are required. It is at all events invariably better that the final product should dissolve in the acetylation mixture, so that precipitation may secure as homogeneous a product as possible.

The method generally adopted for the esterification of secondary cellulose acetates was to dissolve the air-dry material (1 gram) in pure pyridine (30 c.c.), to acetylate with acetic anhydride (20 c.c.) for various times and then to precipitate the samples in water. The white flocculent solids formed were filtered through sintered glass funnels, washed free from pyridine and acetic anhydride, and air-dried. In an alternative procedure, the materials were refluxed together, samples being removed at intervals for precipitation and washing.

For the acetylation of viscose rayon the following procedure was adopted. The air-dry rayon (1 gram) was swollen in 20 c.c. of the swelling mixture, and the swollen fibres were filtered, washed in pure pyridine, and acetylated for various times in a mixture of pyridine (30 c.c.) and acetic anhydride (20 c.c.). The whole was then poured into water and the acetylated material filtered, washed free from the acetylation mixture, and dried. Similar experiments in which the cellulose was refluxed with the esterification mixture are recorded.

### (b) Method of Homogeneous Hydrolysis

To prepare a hydrolysed cellulose acetate a 2 per cent. solution of secondary acetate rayon in acetone was made and N/10 aqueous sodium hydroxide solution sufficient to cause the requisite amount of hydrolysis was slowly added with stirring. The homogeneous liquid was then generally left for about 20 hours at room temperature in order to ensure completion of the hydrolysis, and the solution was poured into water. The solid was filtered off through a sintered glass filter, washed free from acetone and sodium acetate, and dried at 40° C.



### (c) Determination of Acetic Acid Yield

Acetic acid yield was determined in accordance with the procedure outlined in a previous publication<sup>18</sup>, but for convenience and completeness details of the method are included here.

About 0.4 gm. of the acetylated sample was dried for 3 hours at 110° C. and hydrolysed over-night at room temperature with 10 c.c. of an approximately normal solution of potassium hydroxide made up in equal volumes of water and methyl alcohol. The amount of alkali consumed and hence the acetic acid liberated was estimated by adding 10 c.c. of approximately normal sulphuric acid, leaving for half an hour, and then titrating the excess acid with N/10 sodium hydroxide, phenolphthalein being used as indicator. The concentrations of the approximately normal solutions were such that blank determinations made in the absence of cellulose acetate gave a small positive titre with the N/10 alkali, which was allowed for in the calculation. The acetic acid yield is defined as the weight in grams of acetic acid produced from 100 g. of dry cellulose acetate on hydrolysis, and is calculated from the following relation:

$$\text{Acetic acid yield} = \frac{0.6 \times f \times (T - t)}{W}$$

where  $f$  = factor of the N/10 NaOH,

$T$  = titre,

$t$  = blank titre,

and  $W$  = dry weight of cellulose acetate used.

The values recorded for the acetic acid yield of all the acetylated samples considered are the means of duplicate determinations.

### (d) The Determination of Fluidity

The determination of the fluidity of cotton cellulose in cuprammonium hydroxide solution has been considered in detail by Clibbens and Geake<sup>15</sup> and Clibbens and Little<sup>16</sup>; the application of the method to the regenerated cellulose rayons has been described by Ridge, Parsons and Corner<sup>17</sup>. Cuprammonium hydroxide solution hydrolyses cellulose acetate to cellulose (cellulose recovered from a cuprammonium solution of cellulose acetate had an acetic acid yield of 1.3 per cent.), and hence it is possible to determine the fluidity of cellulose acetate by a method similar to those used for cotton and the regenerated celluloses. It will be obvious, however, that since acetic acid is split off when cellulose acetate is dissolved in cuprammonium a weight of cellulose acetate greater than that of cellulose must be dissolved in order to produce a solution of given cellulose concentration. The actual amount of acetate required to produce a 2 per cent. solution of cellulose is given by the relation

$$W = 2V \left( \frac{1}{100 - m} \times \frac{142.9}{142.9 - A} \right)$$

where  $W$  = weight of cellulose acetate in gm.,

$V$  = volume of viscometer in c.c.,

$m$  = per cent. moisture content (gm. water per 100 gm. air-dry cellulose acetate),

$A$  = per cent. acetic acid yield of cellulose acetate.

For the purpose of the work described in this paper, however, most of the fluidities of cellulose acetates have been determined in solutions containing 1 per cent. of cellulose, in order to economise on materials.

The acetic acid split off from the cellulose acetate of course neutralises part of the cuprammonium hydroxide, and so alters the composition of the solvent. It will be shown later that this has a definite but small effect on the fluidity, so that for ordinary purposes it is sufficiently accurate to dissolve the cellulose acetate directly in the solvent rather than first hydrolyse it to cellulose.

The fluidity is calculated as for cotton or regenerated cellulose rayons by the formula:

$$F = \frac{C}{T - (k/T)}$$

where  $F$  = fluidity of solution, in reciprocal poises,  
 $C$  = viscometer constant,  
 $k$  = kinetic energy constant,  
 $T$  = time of outflow in seconds.

#### (e) Purity of the Pyridine employed

Impure pyridine resulted in products which were not white, and for all this work a refined grade was dried over solid sodium hydroxide and distilled in an electrically heated all-glass apparatus fitted with a reflux return head. A water-white product boiling between 114° and 114.5° C. was obtained.

#### (f) Cellulosic Materials used

The samples were in yarn form except No. 2, which was available as a sliver of cut staple fibre; all were freed from oil, soap, or other foreign matter before use. The materials were chosen so as to be reasonably representative of the various types of rayon in production.

(1) *Seraceta*.—Secondary acetate rayon produced by Messrs. Courtaulds Ltd. Yarn denier 140, filament denier 5.

(2) *Celanese FS*.—A regenerated cellulose rayon made by the hydrolysis of acetate rayon, stretched to give high strength. Produced by Messrs. British Celanese Ltd. Filament denier 1.

(3) *Bemberg*.—A regenerated cellulose rayon made by the cuprammonium process by Messrs. British Bemberg. Yarn denier 150, filament denier 1.5.

(4) "*A*" *Quality Viscose Rayon*.—A regenerated cellulose rayon made by the viscose process by Messrs. Courtaulds Ltd. Yarn denier 100, filament denier 5.

(5) *Tenasco*.—A regenerated cellulose rayon of high tensile strength made by the viscose process by Messrs. Courtaulds Ltd. The fluidity of this material is lower than that of (4). Yarn denier 265, filament denier 2.

Figures for the fluidity and acetic acid yield (where applicable) of these materials are given with the results of the acetylation experiments in which they were used.

### III. EXPERIMENTAL RESULTS

#### (a) Effect of Added Acetic Acid on the Fluidity of Celluloses

Although due allowance for the weight of combined acetic acid was made in obtaining the solutions in cuprammonium hydroxide yet it was desirable to study the effect of this liberated acetic acid on the fluidity of the solution, since it changes the composition of the solvent. Accordingly, glacial acetic acid, equivalent in amount to that released from certain cellulose acetates, was added to cuprammonium hydroxide solutions of viscose or secondary acetate rayons, and the fluidities of the solutions determined.

The results, presented in Table I, show a small but definite reduction in fluidity. This has been found for most of the preparations to be described.

Table I

Sample							Fluidity in 2% solution	
							(a)	(b)
(1)	Viscose rayon	...	...	...	...	...	8.8, 8.9	9.5
(2)	Viscose rayon + acetic acid equivalent to secondary acetate rayon (53%)	...	...	...	...	...	6.8, 6.6	8.2
(3)	Viscose rayon + acetic acid equivalent to triacetate (62.5%)	...	...	...	...	...	—	7.6
(4)	Seraceta	...	...	...	...	...	10.3	—
(5)	Seraceta + acetic acid equivalent to triacetate	...	...	...	...	...	8.8	—

**(b) The Effect of Acetylation and of Hydrolysis on the Fluidity**

In order to establish the non-degradative action of the acetylation method two samples of Seraceta and two of viscose rayon were acetylated for ten days, at room temperature and at 60° C. respectively, then carefully hydrolysed out of contact with air with N-potassium hydroxide in alcohol-water solution, and finally re-acetylated as before. At each stage the fluidity of 1 per cent. solutions was determined and the results are expressed in Table II.

**Table II**

	Seraceta				Viscose			
	Sample I		Sample II		Sample I		Sample II	
	Acetic acid yield	Fluidity 1% solution	Acetic acid yield	Fluidity 1% solution	Acetic acid yield	Fluidity 1% solution	Acetic acid yield	Fluidity 1% solution
Original ...	53.8	28	53.8	28	0.0	24	0.0	24
Acetylated material ...	60.8	27	62.5	26	62.0	23	60.8	24
Hydrolysed material...	4.8	28	4.1	30	1.6	25	1.9	25
Re-acetylated material	57.9	28	59.6	26	59.8	23	58.2	24

The validity of the technique described for homogeneous hydrolysis has also been investigated by determining the fluidity of samples of Seraceta hydrolysed in solution to various extents. The samples were not soluble in acetone below an acetic acid yield of 52 per cent., but all dissolved in pyridine. The changes in fluidity shown in Table III indicate that little degradation has occurred.

**Table III**

Sample		Acetic acid yield	Fluidity in 1% solution
Seraceta ...	...	54	28.0
Partially hydrolysed Seraceta	1	52	26.1
	2	47	29.6
	3	46	27.4
	4	44	27.1
	5	43	30.8

**(c) The Acetylation of Secondary Acetate Rayons**

Samples of a commercial secondary acetate rayon were dissolved in pyridine, acetic anhydride was added, and the acetylation carried out in thermostats at 25 and 60° C. The results in Table IV show that the rate of acetylation is not much influenced by temperature in this range, and subsequent work on secondary acetates was therefore done at 25° C.

**Table IV**

	Time of acetylation. (hours)						
	0	$\frac{1}{4}$	1	2	6	24	96
Acetic acid yield ...	25° C.	53.8	56.8	59.9	60.6	60.9	61.6
	60° C.	53.8	60.3	60.6	61.3	60.9	61.6

Further series of acetylated samples were prepared, chiefly for the purpose of obtaining acetylated celluloses covering a range of acetic acid yields and characterised by a random distribution of acetyl groups along molecules of constant mean chain length. In each experiment of the second series 50 gm. of secondary acetate were further acetylated; the fluidities given in Table V show that no degradation has occurred in the preparation of the acetylated samples, which were all white flocculent solids.

Table V

Time of acetylation (hours) ...	...	0	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{2}$	1	4	7	21	27
Acetic acid yield ...	53.8	54.1	57.0	57.3	58.6	59.8	60.6	60.3	61.5	61.5	
Fluidity (1% solution)	28.0	26.5	27.2	28.9	26.2	26.2	24.8	26.3	26.4	27.9	
Time of acetylation (hours) ...	...	0	$\frac{1}{15}$	$\frac{1}{12}$	$5\frac{3}{4}$	240	...	...	...	...	...
Acetic acid yield ...	53.8	57.5	58.3	59.4	62.5	...	...	...	...	...	
Fluidity (2% solution)	9.3	8.7	9.0	7.5	7.3	...	...	...	...	...	

It was at first considered that the slowness of the acetylation when the acetic acid yield approaches that of the triacetate (62.5 per cent.) might be due to the presence of water causing simultaneous hydrolysis. Accordingly, phosphorus pentoxide was introduced into the acetylation mixture, but no improvement was effected.

It is interesting to observe the solubility changes as the acetic acid content of a cellulose acetate rises without change in chain length. Table VI shows these effects qualitatively.

Table VI

Solvent		Acetic acid yield									
		53.8	54.1	57.0	57.3	58.6	59.8	60.3	60.5	61.5	62.5
Acetone ...	...	S	S	S	S	S	P	P	P	P	P
Dioxane ...	...	S	S	S	S	S	S	S	S	P	P
Pyridine ...	...	S	S	S	S	S	S	S	P	P	P
Chloroform ...	...	P	P	S	S	S	S	S		S	S
Methylene chloride and alcohol:—											
90 : 10, by vol.		S	S	S	S	S	S	S	S	S	S
70 : 30, by vol.		S	S	S	S	S	S	S	S	S	S

S = Soluble. P = Partially soluble.

It is well known that secondary cellulose acetates are soluble in acetone, but not completely soluble in chloroform, whilst the triacetates dissolve in chloroform, but not in acetone. The acetic acid yield ranges in which these properties hold are, however, less well known. Table VI shows that solubility in acetone is retained up to about 59 per cent. acetic acid yield whilst solubility in chloroform is possible for all acetic acid yields above 57 per cent. There is thus a small region of acetic acid yield in which acetone solubility and chloroform solubility are both exhibited. It is also seen from the table that methylene chloride mixed with alcohol can be a solvent for materials at all stages of acetylation between 53.8 and 62.5 per cent.

In order to investigate the possibility of using a substantially quicker method of acetylation, experiments were conducted in which pyridine solutions of acetate rayon were boiled under reflux with acetic anhydride in an all-glass (Monax) apparatus. Portions of the solution were removed at intervals, precipitated into distilled water, filtered through sintered glass funnels, washed free from the acetylation mixture, and dried. Timing of the acetylation was begun at the onset of boiling. The results are expressed in Table VII.

It is clear that in all the experiments substantially complete acetylation without degradation was achieved. In whiteness and fibrous nature of the acetylated sample, however, the treatment with 20 c.c. of acetic anhydride plus 30 c.c. of pyridine was by far the best, the other mixtures giving rise

to hard and sometimes yellowish products. As expected, all the products were completely soluble in chloroform (the typical cellulose triacetate solvent), almost completely soluble in pyridine, and about 50 per cent. soluble in acetone. From these results it appears that by using the same acetylation mixture and the same ratios of liquid to acetate rayon as those employed for acetylation at room temperature, complete esterification can be accomplished in two hours by conducting the reaction under reflux.

Table VII

Composition of acetylation mixture per gm. Seraceta	Time of acetylation (hours)	Acetic acid yield, %	Fluidity in 1% solution
	0	53.8	28.0
10 c.c. Acetic anhydride, 40 c.c. pyridine ...	1	62.6	27.0
	2	61.8	29.4
	3	62.0	26.7
20 c.c. Acetic anhydride, 30 c.c. pyridine ...	1	61.8	25.0
	2	62.6	28.2
	3	62.0	27.3
40 c.c. Acetic anhydride, 10 c.c. pyridine ...	1½	62.3	25.8
	2	61.6	27.5
	3	61.0	27.9

#### (d) The Acetylation of Viscose Rayon

The rate of acetylation of air-dry viscose rayon by acetic anhydride in the presence of pyridine is exceedingly slow, but it can be accelerated by a pre-treatment of the material with a reagent that produces swelling of the cellulose. Such swelling is produced, for example, by water, or to a still greater extent by solutions of the strong alkalis, and the rate of acetylation of viscose rayon was observed to be greatly increased by pre-treatment with sodium hydroxide solutions of suitable concentration. Systematic investigations were not, however, pursued along these lines since a sufficient acceleration of the process, with fewer possible complications, was achieved by a pre-treatment of the viscose rayon with a solution of water in the weak base, pyridine, which is a component of the acetylation mixture.

In this connection preliminary measurements were made of the swelling of

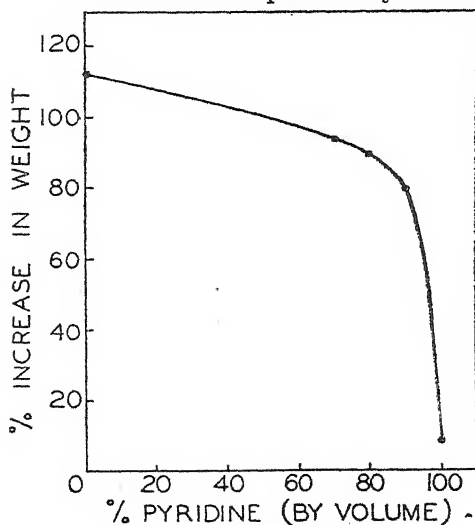


Fig. 1

cellulose in different mixtures of pyridine and water. Regenerated cellulose sheet, previously freed from plasticiser by immersion in many changes of distilled water, was employed in these swelling experiments instead of viscose rayon for reasons of convenience. Although it was realised that (quantatively) the results could not hold for viscose rayon yet it was expected that their application in a general way would be permissible. The increase in weight of the cellulose sheet was used as a measure of the swelling, and was determined after swelling to equilibrium at 25° C. in various mixtures of water and pyridine. The results presented in Fig. 1 show that very little swelling

occurs in pure pyridine, but that a mixture containing only 20 per cent. of water produces nearly as much swelling as pure water.

Experiments were then made to determine the effect on the degree of acetylation of the time and temperature of pre-treatment and of acetylation, for a given acetylation mixture (pyridine-acetic anhydride) and the following three pre-treatments:

- (i) 100 per cent. pyridine.
- (ii) 80 per cent. pyridine, subsequently removed by washing with 100 per cent. pyridine.
- (iii) 80 per cent. pyridine, subsequently replaced by 90 per cent. pyridine, and this again replaced by 100 per cent. pyridine.

The following general conclusions were drawn from the results.

- (a) Acetylation proceeds more rapidly at 60° than at 25° C.
- (b) No real difference between the effects of swelling at 60° C. and 25° C. on the rates of subsequent acetylation was observed, and, further, no improvement occurred by prolonging the swelling beyond two hours.
- (c) As expected, the use of 100 per cent. pyridine as a pre-treatment proved to be of no value. For instance, after acetylating for 48 hours at 60° C., an acetic acid yield of only 5 per cent. was obtained.
- (d) The pre-treatments (ii) and (iii) above gave practically identical results in the acetylation, and values of about 50 per cent. acetic acid yield were obtained in 48 hours at 60° C. However, a further 150 hours were required to complete the acetylation to the triacetate stage.
- (e) It was found that an acetic acid yield of over 60 per cent. was required before the material dissolved in the acetylation mixture.

It appeared, therefore, that a triacetate could be produced by pre-swelling in 80 per cent. pyridine at room temperature for any time greater than 2 hours followed by acetylation at 60° C. for 10 days.

Various changes were made in the technique in an attempt to hasten the acetylation process. For instance, acetyl chloride was substituted for acetic anhydride as acetylating agent, but proved to be less effective. The catalyst pyridine was replaced by dimethylaniline, which was used with both acetic anhydride and acetyl chloride, both dry and air-dry viscose rayon being used. The results were on the whole unsatisfactory; the acetylation of the air-dry rayon proceeded farther than that of the dry material.

Table VIII

Swelling for 1 hour			Swelling for 24 hours		
Time of acetylation (hours)	Acetic acid yield (%)	Fluidity in 1% solution*	Time of acetylation (hours)	Acetic acid yield (%)	Fluidity in 1% solution
Acetylation with 10 c.c. acetic anhydride + 40 c.c. pyridine per gm. viscose rayon :—					
8	46.4	28.1	6	60.9	23.7
12	51.8	28.4	12	53.9	21.7
Acetylation with 20 c.c. acetic anhydride + 30 c.c. pyridine per gm. viscose rayon :—					
3	61.6	22.7	3	60.4	23.3
6	62.2	22.3	6	62.3	22.8
12	60.5	23.8	12	61.7	23.2
Acetylation with 40 c.c. acetic anhydride + 10 c.c. pyridine per gm. viscose rayon :—					
6	56.0	22.9	6	62.4	24.0
12	56.8	29.3	12	62.4	22.7

\* The fluidity of the untreated viscose rayon was 23.9

Experiments have also been conducted in which the swollen viscose rayon is boiled under reflux with the acetylation mixture. The apparatus and acetylating solutions were the same as those described for the reflux acetylation of Seraceta (above), but in addition the air-dry yarn was pre-swollen in a pyridine/water solution (80 per cent. pyridine, 20 per cent. water) at room temperature for 1 and 24 hours. The swelling solution was

removed by filtering through sintered glass filters and the yarn washed in pure pyridine before adding the acetylation medium. (Thus two series of results were obtained and are given in Table VIII). Viscose rayon or swollen viscose rayon being pure cellulose was not soluble initially in the acetylation mixture, but during the course of the esterification it gradually dissolved. No sample was taken for analysis until the whole of the viscose was in solution in order to eliminate any effect of chain length fractionation.

It can be seen from this table that on the whole the mixture composed of 20 c.c. of acetic anhydride and 30 c.c. of pyridine is the best for causing the greatest acetylation together with the least degradation; these samples were also the most white and fibrous. In this connection, swelling for 24 hours seems to produce little improvement over swelling for 1 hour. Further, the samples treated with 20 c.c. of acetic anhydride plus 30 c.c. of pyridine dissolved in the acetylation mixture in a shorter time than those having other treatments. For subsequent acetylation work on other fibres this treatment, together with swelling for 1 hour in the usual mixture was chosen as the most likely to yield useful results from the preparative point of view.

All samples dissolved completely in chloroform, and none dissolved completely in acetone or pyridine.

#### (e) Acetylation of Other Rayons

Celanese FS, Bemberg rayon, and Tenasco proved to be most difficult to acetylate. By pre-swelling in 80 per cent. pyridine solution followed by acetylation at 60° C. the first two attained an acetic acid yield of only 59 per cent. in ten days, but five weeks were needed for the Tenasco to reach this figure.

On account of these unfavourable results an improvement was attempted by acetylation under reflux in the manner previously described.

The air-dry samples were swollen in 80 per cent. pyridine in water solution for 1 hour at room temperature and then acetylated under reflux with the most favourable mixture: 20 c.c. acetic anhydride plus 30 c.c. pyridine per gram material.

Table IX shows that these samples can be almost completely acetylated with but little change in fluidity although it would seem undesirable to prolong the acetylation to the longest times noted.

Table IX

				Time of acetylation (hours)	Acetic acid yield %	Fluidity in 1% solution
Celanese FS	...	...	...	0	1.0	29.5
				10	62.3	28.1
				15	62.9	27.0
				24	61.2	27.9
Bemberg rayon	...	...	...	0	0	12.0
				6	60.0	12.1
				12	60.2	12.5
				24	60.6	15.2
Tenasco	...	...	...	0	0	14.5
				7	61.0	13.2
				12	60.6	15.2
				24	57.0	18.2

#### IV. GENERAL INSTRUCTIONS FOR THE COMPLETE ACETYLATION OF RAYONS

It is emphasized at the outset that complete solution in the acetylation mixture is essential before the sample is precipitated. After each of the acetylations described it is necessary to pour the clear liquid slowly into water, to filter through sintered glass funnels, and to wash the preparation free

from the acetylation mixture with distilled water. Details are given for 1 gram of cellulosic material.

(a) *Secondary Cellulose Acetate*.—Dissolve the air-dry material in 30 c.c. of pure pyridine, add 20 c.c. of acetic anhydride and acetylate for ten days at room temperature. Alternatively, the whole may be boiled under reflux in an all-glass apparatus for 2 hours. Both methods give white products.

(b) *Viscose Rayon*.—Swell the air-dry material over-night at room temperature in 20 c.c. of a mixture of 16 c.c. of pyridine and 4 c.c. of water. Filter the fibres, wash in pure pyridine, and acetylate at 60° C. for 10 days with a mixture of 30 c.c. of pyridine and 20 c.c. of acetic anhydride. The product is not quite white. By conducting the esterification under reflux for 6 hours a white product which is fully acetylated is formed. It is permissible here to reduce the time of swelling to 1 hour.

(c) *Other Cellulosic Rayons*.—The method at 60° C. described above for viscose rayon may be used, but often does not give complete esterification. Acetylation under reflux as described in (b) above is probably the most suitable, although an acetylation time of about 10 hours may be required. These samples will be almost white.

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The data on the swelling of regenerated cellulose sheet in aqueous pyridine were supplied by Dr. R. J. B. Marsden, of these laboratories. Part of the experimental work was done by Mr. G. C. Gibbons and Miss E. Martin.

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# THE JOURNAL OF THE TEXTILE INSTITUTE

## TRANSACTIONS

### 12—THE STRUCTURE OF CELLULOSIC RAYONS. Part II. THE VISCOSITY OF SOLUTIONS OF CELLULOSE ACETATE

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#### I. INTRODUCTION AND SUMMARY

The present paper is devoted to an enquiry into some of the factors influencing the viscosity of solutions of cellulose acetate. The chief object of the work is to find the best method of using viscosity data to obtain a measure of the mean chain length of the acetate molecules in solution. It is appreciated that any method relying upon viscosity data is unlikely to provide values that are accurate in an absolute sense, but the method is so easy experimentally that it seemed desirable to investigate the conditions under which it can be used to provide values that will be accurate relative to a chosen standard.

One characteristic of solutions of long-chain compounds is that their viscosity increases very rapidly as the concentration of solute is raised. Many relations have been proposed to represent this dependence of viscosity upon concentration. It is not intended to discuss these equations here, for they have been adequately considered and inter-related elsewhere<sup>1, 2, 3, 4, 5, 6</sup>. It has been suggested, however, that the equation due to Baker<sup>7</sup> is valid over a greater concentration range than the others. The relation utilised by Staudinger<sup>8</sup>, and extensively considered by him and others, in which the function  $\eta_{sp}/c$  is linearly related to  $c$  for low concentrations of solute, has been the subject of much controversy independent of its application to the determination of molecular weights. Bungenberg de Jong<sup>9</sup> showed that the relation between the logarithm of  $\eta_{sp}/c$  and  $c$  was linear up to high concentrations, and later Staudinger<sup>10</sup> advocated the use of this relation over concentration ranges where the plot of  $\eta_{sp}/c$  against  $c$  is not a straight line. Staudinger also found from experiments on materials with molecules of widely different chain lengths that extrapolation to zero concentration gave identical values of  $\eta_{sp}/c$  whether the extrapolation were made on the direct or on the logarithmic plot.

Relations between the viscosity and temperature of pure liquids have been derived theoretically by Andrade<sup>11</sup>, Sheppard<sup>12</sup>, and others<sup>13</sup>; these are of the form  $\eta = Ae^{B/T}$  where  $A$  and  $B$  are constants, and  $T$  is the absolute temperature. They have been successfully applied to many pure liquids. An equation of identical form has been derived for solutions by Karrer<sup>13</sup>, and found to be valid for solutions of cellulose esters<sup>13, 14, 15, 16</sup>. In an earlier publication Berl and Umstätter<sup>17</sup> had suggested that the viscosity of cellulose ester solutions was inversely proportional to the square of the temperature in degrees Centigrade, but this relation does not appear to have been further used. Lawrence, in a recent discussion<sup>18</sup>, drew attention to the fact that increase of temperature should *increase* the viscosity due to the solute by increasing its kinetic motion. Burgers<sup>19</sup> has stated that

the dependence of viscosity on temperature will vary with the molecular weight of the solute, solutes of low molecular weight causing a decrease of specific viscosity with increase of temperature, and solutes of high molecular weight an increase of viscosity. Actually, a decrease of specific viscosity almost invariably accompanies an increase of temperature, although Staudinger<sup>8,10</sup> working with dilute solutions of highly polymerised polystyrene reported that the value of  $\eta_{sp}/c$  extrapolated to zero concentration was independent of temperature over the range 20–60°C.; later, a direct dependence on temperature seemed to be found<sup>20</sup>. More recently, Mark<sup>21</sup>, from theoretical considerations predicted, and with a small amount of experimental work on rubber and polystyrene confirmed, that the specific viscosity of solutions in good solvents decreases with increasing temperature whereas in poor solvents the specific viscosity increases.

In his earlier work, Staudinger suggested that the value of  $\eta_{sp}/c$  extrapolated to zero concentration was the same for solutions in different solvents, but later recognised<sup>20, 22, 23, 24</sup>, by the provision of different  $K_m$  values in his equation (see below) for cellulose and cellulose derivatives in various solvents, that this quantity did in fact vary from one solvent to another. The initial decrease in viscosity that occurs when small amounts of water are added to solutions of cellulose esters in organic solvents has often been mentioned<sup>25, 26, 27</sup>, but Staudinger<sup>10</sup> was able to add up to 50 per cent. of benzene or 25 per cent. of certain other organic liquids to a solution of cellulose nitrate in butyl acetate without causing any alteration in  $\eta_r$  or  $\eta_{sp}/c$ . Furthermore, the addition of from 2 to 10 per cent. of water to acetone solutions of cellulose nitrate did not cause a change in  $\eta_r$ .

Another factor likely to alter the viscosity is a variation in the number of ester or ether groups attached to the cellulose chain. It was shown by Staudinger<sup>23</sup> that in a solvent in which both acetates dissolved the viscosity of a secondary cellulose acetate was always greater than that of the corresponding triacetate of the same chain-length. It was also found<sup>24</sup> that the limiting values of  $\eta_{sp}/c$  for three methyl- or ethyl- celluloses of the same chain length increased with the amount of combined methoxyl or ethoxyl.

Reference has already been made to Staudinger's use of the function  $\eta_{sp}/c$ . His main work in this field has of course been the correlation of the viscosity of solutions of long-chain compounds, by means of this function, with the molecular weight or chain length of the compound. He began<sup>8</sup> by studying the viscosities of long-chain paraffins, acids, esters, and alcohols of known chain-length, and proposed the empirical equation  $\lim_{c \rightarrow 0} \eta_{sp}/c = K_m \times M$  to represent his results,  $K_m$  being a constant for a given

series of polymers, and  $M$  the molecular weight;  $\lim_{c \rightarrow 0} \eta_{sp}/c$  is now generally referred to as the "intrinsic viscosity," and denoted by  $[\eta]$ . He then prepared polystyrenes, polyvinyl acetates, and polyoxymethylenes and examined them cryoscopically; the equation connecting intrinsic viscosity and molecular weight was again found to be valid up to the limiting molecular weight determinable cryoscopically—about 10,000. Determinations of the osmotic pressures of solutions of these polymers, of rubbers, and of celluloses were then made to confirm the equation for these materials of still higher molecular weight. It is important to note, however, that most high polymers used in work of this kind have molecules covering a range of molecular weights, and that osmotic pressure methods give a *number-average* molecular weight, whilst the viscosity method gives a *weight-average* molecular weight<sup>28</sup>, and hence osmotic pressure methods should not be used to obtain the value of  $K_m$  unless the material has been well fractionated, so that it is practically homogeneous with respect to chain-length.

Staudinger's work stimulated theoretical treatments of the problem, and these have definitely pointed to a relation between the viscosity of

dilute solutions of a long-chain substance and its molecular weight. (The equation due to Flory<sup>29</sup> relating the viscosity of molten polymers to the square root of the molecular weight is not considered pertinent here). For example, Burgers<sup>30</sup> derived an expression similar to the Staudinger equation on the assumption that the molecules are very long, are so far apart that they do not hinder one another's motion, and have negligible Brownian movement. Huggins<sup>31</sup> has also deduced Staudinger's equation for very long, randomly-kinked molecules in dilute solution, using a model in which the molecule is taken as a series of spheres connected by rigid rods.

The Staudinger equation has not been universally accepted. Thus Dobry<sup>32</sup> and Buchner and Samwel<sup>33</sup> contend that only osmotic pressure methods are reliable, and that the results obtained from them do not agree with the viscosity equation. Eisenschitz and Rabinowitsch<sup>34</sup> conclude that neither osmotic pressure nor viscosimetric methods are of value since, at the concentrations normally used, the dissolved particles do not move independently. Hess and Sakurada<sup>35</sup>, after a survey of the position, also conclude that the Staudinger method of molecular weight determination cannot be applied to cellulose derivatives.

On the other hand, Obogi and Broda<sup>36</sup> have compared osmotic pressure and viscosimetric methods and state that the Staudinger relation holds as an approximate rule up to a molecular weight of 60,000. Schulz<sup>37</sup>, from work on polystyrene, polyisobutylene, and cellulose nitrate, concludes that the viscosity method of determining molecular weight is not invalidated by heterogeneity provided this is not too great. An interesting proof of the validity of the Staudinger equation has been given by Kraemer and van Natta<sup>38</sup>, and by Baker, Fuller and Heiss<sup>39</sup>, as a result of their work on  $\omega$ -hydroxydecanoic acid self-polyesters. The chain lengths of these were determined by direct titration of the carboxyl groups, and a comparison with the intrinsic viscosities showed that the Staudinger equation was valid down to a molecular weight of 5,000, below which  $K_m$  gradually increased. Association of the polymers in solution was stated to be negligible. Similar drifts in  $K_m$ , becoming constant in the chain-length range of natural products have been found by Staudinger<sup>23, 40</sup> for polyvinyl acetate, polystyrene, and cellulose acetate.

Kraemer has determined molecular weights of high polymers with the ultracentrifuge, and has compared the values so obtained with the intrinsic viscosities of the substances; this work represents the most comprehensive correlation so far made between viscosity and molecular weight determined by a method to which no exception can be taken. Various technical and fractionated cellulose acetates were examined, and the intrinsic viscosity was found to be a linear function of molecular weight over a wide range of values (50,000—250,000)<sup>28, 41, 42</sup>. Similar results were obtained for cellulose, cellulose nitrate, and ethylcellulose, and the conclusion was drawn that the intrinsic viscosity is determined essentially by the chain length, and is relatively slightly affected by solvation or aggregation of the molecules, or by minor changes of chemical composition. A comprehensive summary of the literature on this subject has recently been presented by Lauffer,<sup>43</sup> who concludes that "a linear relationship between intrinsic viscosity and molecular weight exists for each homologous or polymeric series," although the relation may not always be one of direct proportionality.

The work now to be described was initiated with two main objects. In the first place, it was desired to investigate the methods available for determining the intrinsic viscosity  $[\eta]$  from the experimental viscosity data, in order that an accurate value might be obtained with the utmost economy of effort. In the paper just referred to Lauffer<sup>43</sup> mentions three methods of determining  $[\eta]$ .

(1)  $\eta_{sp}$  is plotted as a function of  $c$ , and the tangent to the curve at  $c = 0$  is drawn. The slope of this tangent is

$$[\eta] = \lim_{c \rightarrow 0} \eta_{sp}/c$$

(2)  $\log \eta_r$  is plotted against  $c$ , giving an approximately linear relation over a fair concentration range, and  $(\log \eta_r)/c$  is evaluated. Natural logarithms are used, and when  $\eta_{sp} = \eta_r - 1$  is very small, then

$$\frac{\log \eta_r}{c} \simeq \frac{\eta_r - 1}{c} = [\eta].$$

(3) A power series  $\eta_{sp} = Ac + Bc^2 + Cc^3 \dots$  is fitted to the data, and

$$[\eta] = \lim_{c \rightarrow 0} \eta_{sp}/c = A$$

These methods are laborious, and demand a reasonably large number of viscosity determinations at different concentrations to give an accurate value of  $[\eta]$ ; the same objection applies to Staudinger's method of plotting  $\eta_{sp}/c$  against  $c$ , and extrapolating to zero concentration. Two additional methods have now been examined in some detail; these are

(i)  $\eta_r^{\frac{1}{3}}$  is plotted against  $c$ , giving an excellent straight line over a wide concentration range, and the intrinsic viscosity evaluated as

$$[\eta] = 8 \frac{d\eta_r^{\frac{1}{3}}}{dc}$$

(2)  $\log \eta_{sp}/c$  is plotted against  $c$ , this also giving an excellent straight line over a wide concentration range, and is extrapolated to obtain the intercept on the axis of zero concentration. The intrinsic viscosity is thus obtained as  $[\eta] = \text{antilog} \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$

In both these methods the linear relations are so good that accurate values of  $[\eta]$  can be obtained from viscosity determinations at three concentrations only. As a result of the examination of these methods the conclusion has been reached that the method of calculating  $[\eta]$  from the slope of the  $\eta_r^{\frac{1}{3}}$  plot is preferable to that using the zero intercept on the  $\log (\eta_{sp}/c)$  diagram, in that it provides more regular results with fewer anomalies. The relation between the constants of these two equations is described in an Appendix to this paper.

The second main object of the work to be described was to derive a set of values of  $K_m$  which could be used subsequently for the determination of the chain lengths of a variety of cellulosic derivatives differing in chemical composition. For this work, the effects of temperature, solvent, and acetic acid yield were studied and also some aspects of the oxidation of cellulose acetate. The values of  $K_m$  are given in Section IV of the paper, together with some chain lengths calculated with their aid. It is desirable to emphasize here that no claim is made that these chain lengths are accurate in an absolute sense; what has been done is to accept one value as standard (using what appeared the most probable value for this standard), and to calculate the other values relative to this one. It is hoped that as the result of work now proceeding in these laboratories it may be possible in the not too distant future to determine the chain lengths of some of the materials examined by an absolute method, and so obtain chain length values that will be accurate in an absolute as well as a relative sense.

## II. EXPERIMENTAL METHODS

### (a) Preparation of Acetylated and Hydrolysed Samples

The cellulosic materials used for the experimental work were commercial samples of viscose and secondary acetate rayons which had been freed from all oil and soap, and the same materials acetylated or de-acetylated by methods which produce negligible degradation and ensure a random distribution of the different side groups; these methods have been described in Part I of this series.<sup>44</sup> The determination of the acetic acid yield of the materials used has also been separately described.<sup>45</sup>

**(b) The Determination of Viscosity and Density**

Samples of the material were dried in vacuo over phosphorus pentoxide, weighed, and transferred to glass-stoppered tubes. The requisite amount of solvent was added from a burette, and the tube and contents were shaken on a mechanical shaker for 17 hours. The viscometers used were made to the specifications of the British Standards Institution and were of the Ostwald type, those in the lower viscosity ranges being pipette-filled. For the very low viscosity range, an Ostwald type viscometer was specially designed with a time of flow for acetone of about 200 seconds. The filled viscometers were fixed vertically in a thermostat maintained constant to  $0.05^{\circ}\text{C}$ ., the temperature being checked by a thermometer calibrated by the National Physical Laboratory. A suitable cover over the viscometer ensured that no vapour of the solvent escaped while the viscosity was being determined, and the time of flow of each solution was determined five times with the aid of a stop-watch calibrated at intervals with an electric stop-clock. The viscometers were all calibrated with air-free distilled water as ultimate reference liquid, the value of 1.005 centipoises for the viscosity of water at  $20^{\circ}\text{C}$ ., as advocated by Bingham,<sup>46</sup> being taken as standard. Except where otherwise stated the viscosities were determined at  $20^{\circ}\text{C}$ .

The viscometers were so designed that no kinetic energy correction was needed, and since no pressure other than that of the column of liquid itself was used the viscosity was calculated by means of the equation

$$\eta = K\rho t$$

where  $\eta$  is the viscosity of the liquid in centipoises,

$\rho$  is the density of the liquid relative to that of water at  $4^{\circ}\text{C}$ .,

$t$  is the time of flow in seconds,

and  $K$  is the constant of the particular viscometer used.

Other symbols used are:

$\eta_r$  the relative viscosity =  $\eta/\eta_0$ , where  $\eta$  is the viscosity of the solution and  $\eta_0$  that of the solvent.

$\eta_{sp}$  the specific viscosity =  $\eta_r - 1$

$\lim_{c \rightarrow 0} \eta_{sp}/c$  is the intrinsic viscosity  $[\eta]$ ,  $c$  being the concentration of the solute in grams per litre of added solvent.

The densities of the solvents were determined at  $20^{\circ}\text{C}$ . with pyknometers that had been calibrated with air-free distilled water. The densities of the solutions were not determined as they did not differ sufficiently from those of the solvents to alter the results significantly.

**III. EXPERIMENTAL RESULTS AND DISCUSSION****(a) The Viscosity-Concentration Relation**

The viscosities at  $20^{\circ}\text{C}$ . of acetone solutions of the secondary cellulose acetate rayon Seraceta were determined over the concentration range 0 to 44 grams per litre. The results are presented in two sections in Table I, the first section giving a general survey over the concentration range, the second a more detailed examination of the region of low concentrations. The two series of determinations were made at different times with different batches of acetone, which probably accounts for the slight difference in the viscosities of the solvent. The results are given in the Table to more places of decimals than the accuracy of the viscometry warrants; this has been done in order that accuracy should not be lost in their mathematical manipulation. The data were used to test the Baker equation,  $\eta_r = (1 + \rho c)^n$ , for different values of  $n$  by plotting  $\eta_r^{1/n}$  against  $c$  for integral values of  $n$  between 1 and 10. For values of  $n$  from 1 to 6 the curves were concave upwards, and when  $n$  was 9 or 10 they were convex upwards. The curve for  $n=7$  was very slightly concave upwards, whilst that for  $n=8$  was a very good straight line with perhaps a slight tendency to become convex upwards at the highest concentrations. This is shown by the data of

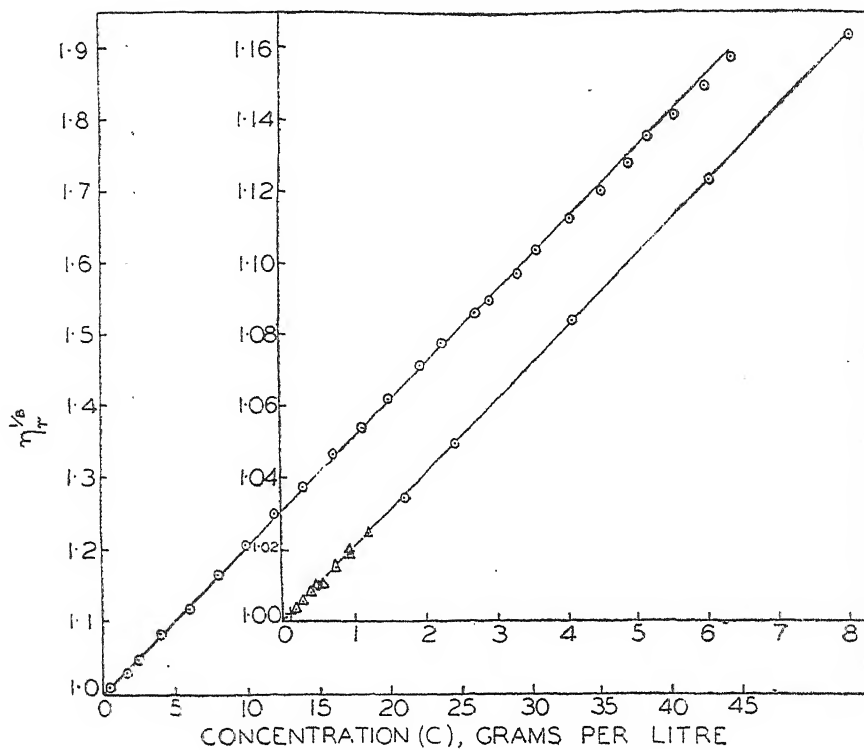


Fig. 1

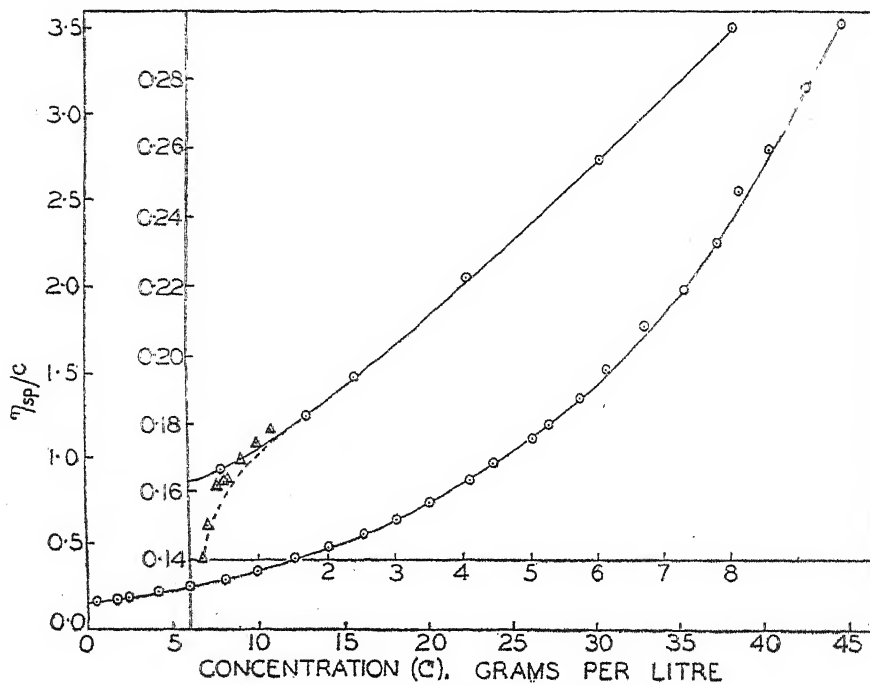


Fig. 2

Table II, which gives values of  $(\eta_r^{1/n} - 1)/c$  for different values of  $c$  and  $n$ . As  $c$  increases this function will increase or decrease according as the curve is concave or convex upwards, whereas if the graph is a straight line the function will have a constant value. The greatest degree of constancy is attained when  $n=8$ , and in the subsequent work the Baker equation is therefore used in the form  $\eta_r^{\frac{1}{8}} = 1 + pc$ .

The results presented in Table I are variously plotted in Figs. 1, 2 and 3, and on these the following comments may be made:

(1) The plot of the one-eighth power of the relative viscosity against the concentration is a good straight line, (Fig. 1) and the enlarged diagram of the low concentration region shows that the linear relation applies down to the lowest concentration examined. The equation  $\eta_r^{\frac{1}{8}} = 1 + pc$  therefore satisfactorily represents the data over the concentration range 0 to 40 grams per litre.

(2) In Fig. 2  $\eta_{sp}/c$  is plotted against the concentration. Staudinger originally suggested that this quantity tends to a constant value at low concentrations. Fig. 2 provides no evidence of such a tendency; indeed the enlarged diagram of the low-concentration region suggests that there is a point of inflexion below which the value of  $\eta_{sp}/c$  decreases rapidly as the concentration is further lowered.

Table I  
Viscosities of Acetone Solutions of Seraceta at 20° C.

Concentration (gram/litre)	$\eta$ centipoises	$\eta_r$	$\eta_r^{\frac{1}{8}}$	$\eta_{sp}/c$	$\text{Log}_{10}(\eta_{sp}/c)$
0.000	0.326	1.0000	1.0000	—	—
0.498	0.353	1.0828	1.0100	0.1663	1.2208
1.718	0.428	1.3129	1.0346	0.1821	1.2604
2.414	0.479	1.4693	1.0493	0.1944	1.2887
4.082	0.622	1.9080	1.0841	0.2224	1.3472
6.010	0.830	2.5460	1.1239	0.2572	1.4103
8.004	1.096	3.3620	1.1637	0.2951	1.4700
9.960	1.444	4.4294	1.2045	0.3443	1.5370
12.104	1.931	5.9233	1.2490	0.4068	1.6093
14.016	2.471	7.5798	1.2881	0.4694	1.6716
16.070	3.222	9.8834	1.3316	0.5528	1.7426
18.046	4.030	12.362	1.3693	0.6296	1.7991
20.008	5.097	15.635	1.4101	0.7315	1.8642
22.254	6.564	20.135	1.4554	0.8598	1.9344
23.734	7.759	23.801	1.4862	0.9607	1.9826
26.022	9.703	29.764	1.5283	1.1054	0.0435
26.990	10.78	33.068	1.5485	1.1881	0.0749
28.850	12.98	39.816	1.5849	1.3454	0.1289
30.425	15.38	47.178	1.6189	1.5178	0.1812
32.765	19.16	58.773	1.6685	1.7633	0.2463
35.030	22.78	69.877	1.7004	1.9662	0.2936
37.000	27.38	83.988	1.7399	2.2429	0.3508
38.265	32.07	98.374	1.7746	2.5447	0.4056
40.125	36.83	112.98	1.8056	2.7908	0.4457
42.350	43.96	134.85	1.8460	3.1606	0.4993
44.275	51.39	157.64	1.8824	3.5379	0.5487
0.000	0.322	1.0000	1.0000	—	—
0.176	0.330	1.0248	1.0031	0.1409	1.1489
0.290	0.336	1.0435	1.0053	0.1500	1.1761
0.403	0.343	1.0652	1.0079	0.1618	1.2089
0.496	0.348	1.0807	1.0098	0.1627	1.2114
0.513	0.349	1.0839	1.0101	0.1636	1.2136
0.752	0.363	1.1273	1.0151	0.1693	1.2286
0.954	0.374	1.1615	1.0189	0.1693	1.2286
0.960	0.376	1.1677	1.0196	0.1747	1.2423
1.203	0.391	1.2143	1.0246	0.1781	1.2508

Table II  
Values of  $(\eta_r^{1/n}-1)/c$  for Different Values of  $c$  and  $n$

$c$	$n=1$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$	$n=7$	$n=8$	$n=9$	$n=10$
0.498	.166	.0815	.0540	.0404	.0321	.0267	.0228	.0201	.0179	.0161
1.718	.182	.0849	.0553	.0410	.0326	.0270	.0231	.0201	.0179	.0161
2.414	.194	.0879	.0567	.0418	.0331	.0274	.0234	.0204	.0181	.0162
4.082	.222	.0934	.0589	.0429	.0338	.0277	.0237	.0206	.0182	.0163
6.010	.257	.0991	.0591	.0438	.0342	.0280	.0238	.0206	.0182	.0163
8.004	.295	.1041	.0622	.0442	.0343	.0280	.0236	.0204	.0180	.0161
9.960	.344	.1109	.0649	.0452	.0348	.0283	.0238	.0205	.0180	.0161
12.104	.407	.1185	.0670	.0463	.0354	.0286	.0239	.0206	.0181	.0164
16.070	.553	.1335	.0713	.0481	.0362	.0289	.0236	.0206	.0180	.0160
20.008	.732	.1477	.0750	.0494	.0366	.0290	.0240	.0205	.0179	.0158
23.734	.961	.1635	.0791	.0509	.0373	.0293	.0241	.0205	.0178	.0157
26.990	1.190	.1760	.0819	.0519	.0375	.0293	.0240	.0203	.0176	.0155
30.425	1.518	.1930	.0859	.0533	.0380	.0296	.0241	.0203	.0176	.0154
35.030	1.966	.2100	.0890	.0540	.0382	.0301	.0238	.0200	.0172	.0151
40.125	2.792	.2401	.0956	.0563	.0392	.0299	.0240	.0201	.0172	.0152
44.275	3.537	.2611	.0994	.0574	.0395	.0299	.0239	.0199	.0170	.0149

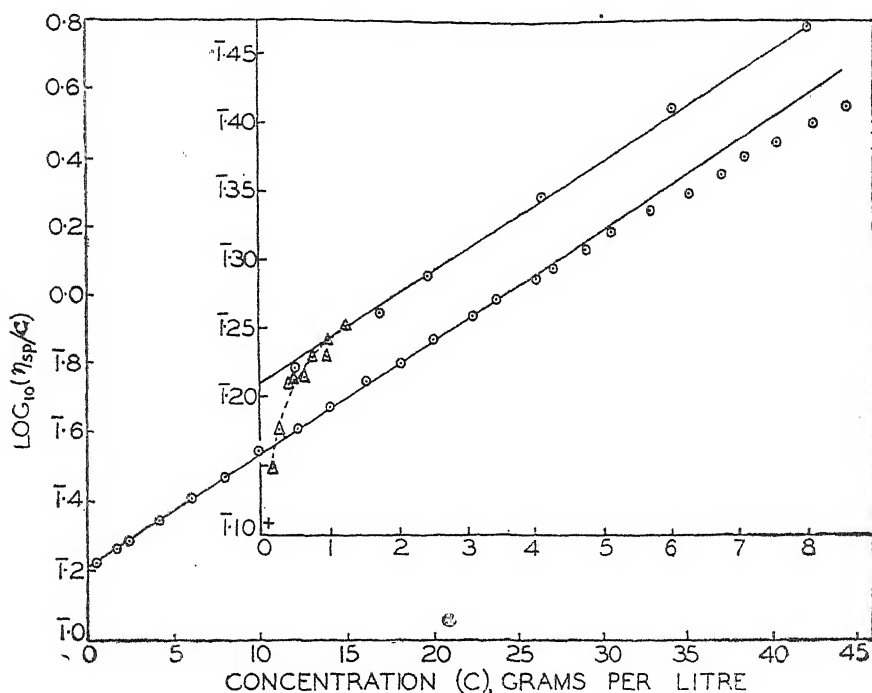


Fig. 3

(3) In Fig. 3  $\log_{10} (\eta_{sp}/c)$  is plotted against the concentration. The plot is linear over the concentration range 1 to 25 grams per litre, but as in Fig. 2 there appears to be a tendency for the viscosity function to decrease rapidly at the lowest values of the concentration. [The use of  $\log (\eta_{sp}/c)$  has been advocated by Staudinger<sup>10</sup> in preference to  $\eta_{sp}/c$  for systems for which the latter is unsatisfactory].



(4) As mentioned above, there is a suggestion (Figs. 2 and 3) that at very low concentrations the  $\eta_{sp}/c$  and  $\log (\eta_{sp}/c)$  curves may turn downwards making the former sigmoid and the latter non-linear. At such low concentrations the experimental error in preparing small volumes of solution is relatively large, and 500 c.c. of a 0.01 per cent. solution were made up and the viscosity measured to check the point. The time of flow of this solution was 205.2 secs. compared with 202.6 secs. for acetone, and the results obtained were :

$$\begin{aligned} c &= 0.0998 \text{ gram per litre.} \\ \eta_r &= 1.0128 \\ \eta_r^{\frac{1}{8}} &= 1.0016 \\ \eta_{sp}/c &= 0.1283 \\ \log_{10} \eta_{sp}/c &= \bar{1}.1081 \end{aligned}$$

These values of  $\eta_{sp}/c$  and  $\log_{10} (\eta_{sp}/c)$  lie so far below the curves in Figs. 2 and 3 that they have not been inserted; yet the value of  $\eta_r^{\frac{1}{8}}$  falls reasonably on the straight line of Fig. 1 (plotted as a cross on Fig. 1). It seems possible, therefore, that the apparent bending of the  $\eta_{sp}/c$  and  $\log (\eta_{sp}/c)$  curves in the low concentration region may be real, but its more detailed study would require facilities for very accurate viscometry, and the question was not pursued further.

(5) The curve of Fig. 2 was produced to cut the  $\eta_{sp}/c$  axis, the lower points at very low concentrations being neglected. The intercept on this axis gives  $[\eta]$  directly as  $\lim_{c \rightarrow 0} \eta_{sp}/c$ . Similarly the straight line portion of Fig. 3 was produced to cut the  $\log_{10} (\eta_{sp}/c)$  axis, the intercept being  $\text{Lim}_{c \rightarrow 0} \log (\eta_{sp}/c)$ , the antilog of which is also  $[\eta]$ . Finally from Fig. 1  $[\eta]$  can be obtained by multiplying the slope of the line by eight, so that three estimates of its value are available :

$$[\eta] = 8 \frac{d(\eta_r^{\frac{1}{8}})}{dc} = 0.1640$$

$$[\eta] = \lim_{c \rightarrow 0} \eta_{sp}/c = 0.1630$$

$$\begin{aligned} [\eta] &= \text{antilog} \left\{ \lim_{c \rightarrow 0} (\log \eta_{sp}/c) \right\} = \text{antilog } \bar{1}.211 \\ &= 0.1626 \end{aligned}$$

These values are within the limits of error identical, and there is no obvious reason why any one of them should be preferred to any other. Linear extrapolation is so greatly to be preferred, however, that in the later work the determination of  $[\eta]$  as  $\lim_{c \rightarrow 0} \eta_{sp}/c$  was not further considered, attention being confined to the two linear methods. This obviously made it possible very greatly to reduce the number of viscosity determinations.

#### (b) The Effect of Temperature

To examine in a general way the effect of temperature on the viscosity of solutions of cellulose acetate, pyridine was chosen as solvent in preference to acetone so that viscosities could be measured over a wider range of temperature. The results of determinations of the viscosities of solutions of Seraceta in pyridine over the temperature range 20–70°C. are given in Table III. Fig. 4 shows the plot of  $\eta_r^{\frac{1}{8}}$  against  $c$ , and Fig. 5 that of  $\log (\eta_{sp}/c)$  against  $c$ . Both methods of plotting give a series of reasonably good straight lines, those of Fig. 4 showing a decrease of slope with increase of temperature, and those of Fig. 5 a decrease of intercept on the axis of zero concentration together with a slight decrease of slope. Estimates of the intrinsic viscosity  $[\eta]$  were obtained on the basis of these linear relations; the figures are given in Table IV.

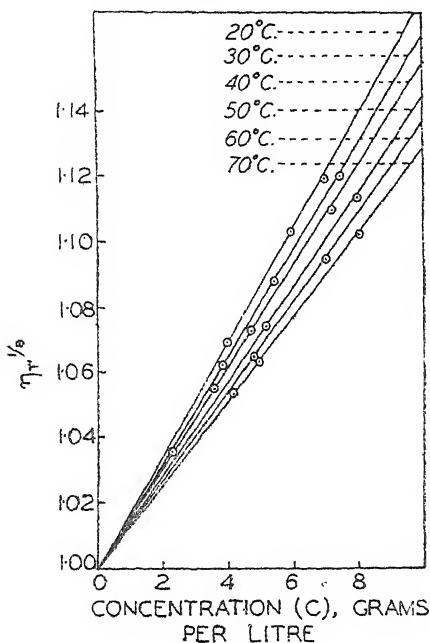


Fig. 4

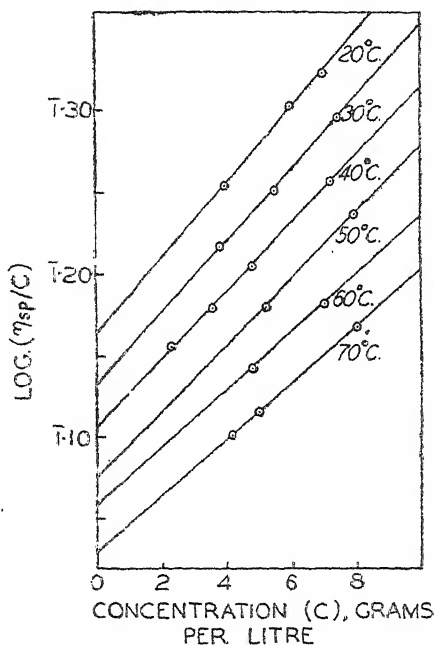


Fig. 5

Table III  
Viscosities of Pyridine Solutions of Seraceta, 20-70°C.

Temperature, °C.	Concentration* (c) (grams/litre)	$\eta_{sp}$	$\eta_{sp}^{\frac{1}{2}}$	$\text{Log}_{10}(\eta_{sp}/c)$
20	3.943	1.7085	1.0693	1.2545
"	5.928	2.1903	1.1030	1.3027
"	6.923	2.4562	1.1189	1.3229
30	3.800	1.6262	1.0627	1.2169
"	5.431	1.9692	1.0884	1.2515
"	7.447	2.4759	1.1200	1.2971
40	2.270	1.3254	1.0358	1.1564
"	3.539	1.5358	1.0551	1.1801
"	4.732	1.7592	1.0732	1.2053
"	7.201	2.3015	1.1098	1.2571
50	5.140	1.7791	1.0747	1.1806
"	7.930	2.3700	1.1139	1.2374
60	4.762	1.6625	1.0656	1.1434
"	7.000	2.0673	1.0950	1.1832
70	4.124	1.5201	1.0537	1.1008
"	4.969	1.6491	1.0645	1.1160
"	8.023	2.1833	1.1025	1.1688

\* Concentrations were determined at room temperature.

Table IV  
Intrinsic Viscosities of Pyridine Solutions of Seraceta, 20-70°C.

Temperature °C. :—	20	30	40	50	60	70
$[\eta] = 8d\eta_{sp}/dc \dots \dots \dots$	0.139	0.130	0.124	0.116	0.109	0.103
$[\eta] = \text{antilog} \left\{ \lim_{c \rightarrow 0} (\log \eta_{sp}/c) \right\}$	0.146	0.136	0.128	0.119	0.114	0.107

Unlike the results given in section (a), the values obtained by the two methods differ appreciably, but the figures themselves provide no evidence to justify the choice of one set in preference to the other.

Owing to the different concentrations at which the viscosities were measured, the data of Table III cannot be used directly to demonstrate the

effect of temperature on the viscosity of solutions of cellulose acetate in pyridine. The linear relation between  $\eta_r^{\frac{1}{2}}$  and  $c$  has therefore been used to calculate the relative viscosities at concentrations of 1, 2, 4, 6 and 8 grams per litre; these values are plotted in Fig. 6.

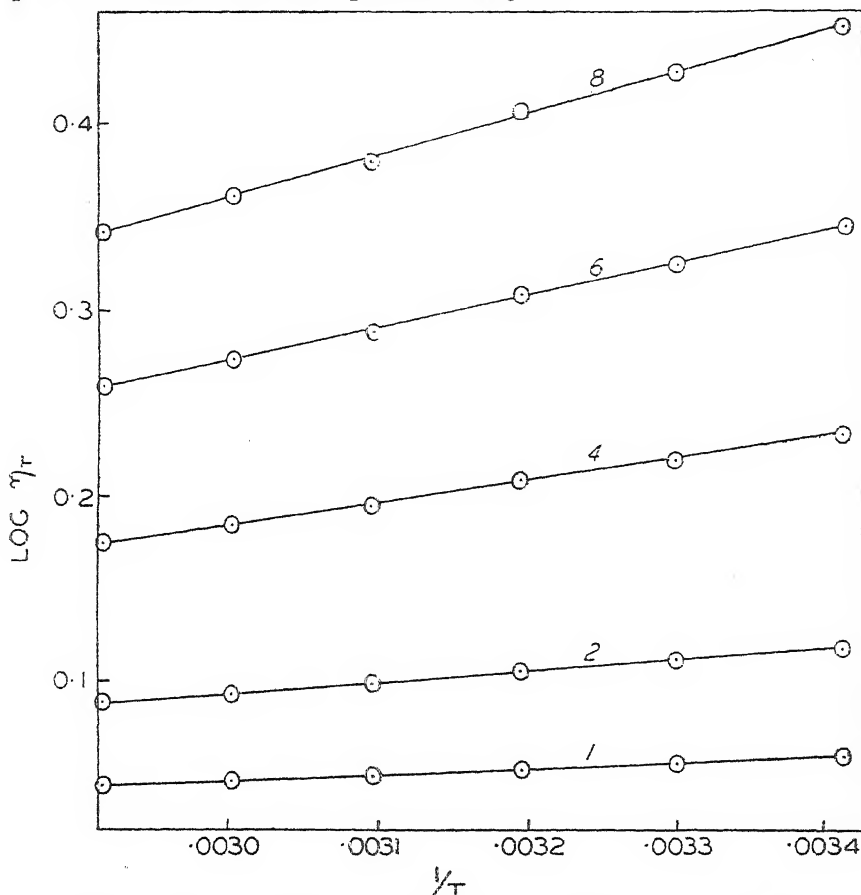


Fig. 6. The concentration in grams per litre is indicated against each line.

It has already been mentioned that Andrade<sup>11</sup> and Sheppard<sup>12</sup> have proposed an equation of the form  $\eta = Ae^{b/T}$  to represent the relation between the temperature and the viscosity of a pure liquid, and that Karrer<sup>13</sup> has derived an equation of identical form for solutions. If both these relations apply, then it follows that the *relative* viscosity of a solution should also conform to the same relation and hence that the plot of  $\log \eta_r$  against  $1/T$  should be a straight line. Fig. 6 shows that an excellent straight line is obtained for each solution, indicating a large degree of conformity with the above relation over the temperature range examined.

The viscosities of acetone solutions of Seraceta, of a sample of Seraceta oxidised by sodium hypochlorite in neutral solution, and of fractions of different molecular chain length derived from these by methods to be described in a later paper of this series, have been determined at 20, 25, 30 and 35°C., three concentrations of solution being examined for each material at each temperature. The results obtained with Seraceta and the fractions prepared from it are given in Table V. In Fig. 7  $\eta_r^{\frac{1}{2}}$  is plotted against concentration, giving a series of straight lines that decrease in slope with increasing temperature. (In order to avoid confusion the data for the original Seraceta are not plotted on this Figure). The lines for fraction 6

are less satisfactory than the others; the lines shown are the best straight lines that can be drawn through the three given points and they pass above the points at the lowest concentration, through those at the intermediate concentration, and below those at the highest concentration, suggesting that these points really lie on a curve that is slightly concave upwards. If this is so then the values of  $[\eta]$  obtained by using the best straight lines through all the points will be too high, and better values would be obtained by using the data for the lowest concentrations only.

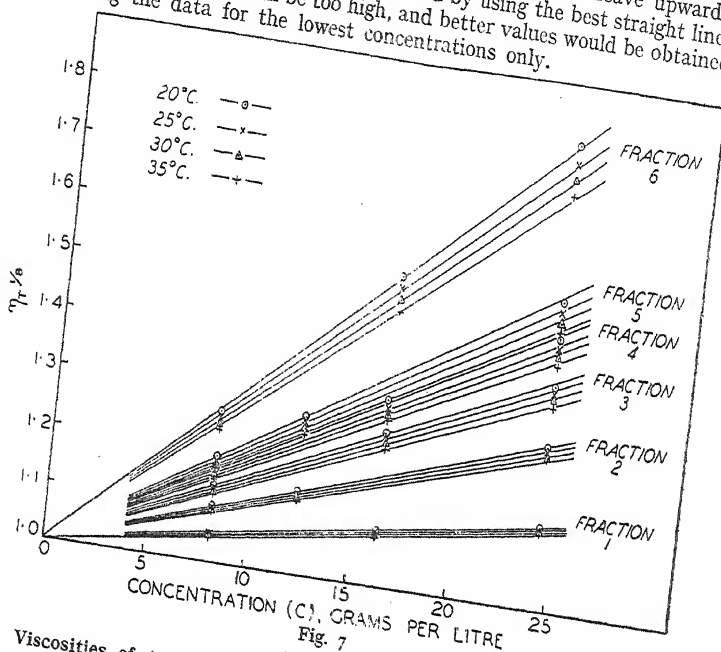


Fig. 7

Table V  
Viscosities of Acetone Solutions of Seraceta and its Fractions at Different Temperatures

Sample and concentration (grams/litre)		Values of $\eta$ ; centipoises			
		20° C.	25° C.	30° C.	35° C.
Solvent	0.000				
Original Seraceta...	8.155	0.322	0.306	0.292	0.280
	16.31	1.101	1.002	0.9194	0.8424
	24.46	3.260	2.892	2.562	2.274
Fraction 1...	8.155	8.287	7.158	6.238	5.439
	16.31	0.4680	0.4421	0.4193	0.3968
	24.46	0.6723	0.6270	0.5868	0.5488
Fraction 2...	8.155	0.9566	0.8788	0.8119	0.7698
	16.31	0.6775	0.6259	0.5839	0.5459
	24.46	0.9473	0.8700	0.8034	0.7405
Fraction 3...	8.155	2.337	2.101	1.888	1.789
	16.31	0.8718	0.8021	0.7415	0.6855
	24.46	2.067	1.882	1.703	1.524
Fraction 4...	8.155	4.312	3.822	3.404	3.035
	16.31	1.068	0.9768	0.8969	0.8239
	24.46	2.954	2.611	2.310	2.082
Fraction 5...	8.155	6.829	5.968	5.230	4.614
	16.31	1.226	1.112	1.016	0.9315
	24.46	2.138	1.959	1.750	1.573
Fraction 6...	8.155	9.530	8.226	7.150	6.279
	16.31	2.030	1.795	1.605	1.442
	24.46	9.690	8.279	7.137	6.170
		34.97	28.90	24.31	20.40

Fig. 8 is a plot of  $\log (\eta_{sp}/c)$  against  $c$  for the same data, those for the original Seraceta being again omitted; a series of straight lines is obtained, and as with the pyridine solutions both the slopes of these lines and their intercepts on the axis of zero concentration decrease with increasing temperature.

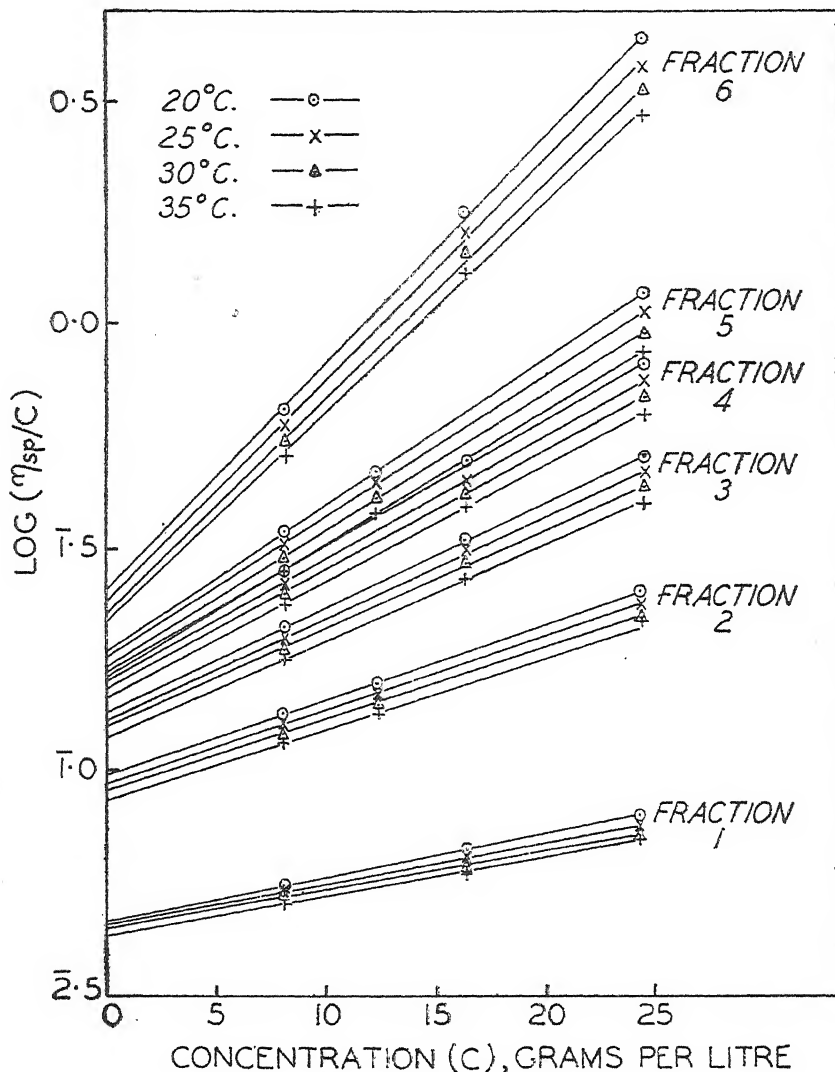


Fig. 8

Values of  $[\eta]$  obtained by the two methods of plotting are given in Table VI. The two methods lead to appreciably different results but again there is no internal evidence justifying the choice of one method in preference to the other. It should be noted, however, that the data for the original Seraceta at 20°C. constitute an independent set of determinations which ought to give the same result as the data of Table I; the values of  $[\eta]$  obtained are

$$[\eta] = 8d\eta_{sp}/dc = 0.1640 \text{ and } 0.1638$$

$$[\eta] = \text{antilog} \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\} = 0.1626 \text{ and } 0.1618$$

**Table VI**  
**Intrinsic Viscosities of Acetone Solutions of Seraceta and its Fractions, 20-35°C.**

$$(a) = 8d\eta_r^{\frac{1}{2}}/dc \quad (b) = \text{antilog} \left\{ \lim_{c \rightarrow 0} (\eta_{sp}/c) \right\}$$

Temperature, °C.	20		25		30		35	
Sample	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Original Seraceta ...	·164	·162	·158	·156	·152	·149	·146	·142
Fraction 1 ...	·047	·046	·046	·046	·045	·045	·044	·043
Fraction 2 ...	·094	·098	·091	·094	·088	·091	·085	·084
Fraction 3 ...	·128	·136	·124	·131	·120	·126	·115	·119
Fraction 4 ...	·156	·168	·145	·160	·145	·155	·140	·147
Fraction 5 ...	·176	·188	·170	·179	·163	·172	·157	·163
Fraction 6 ...	·258	·255	·248	·240	·238	·227	·229	·216

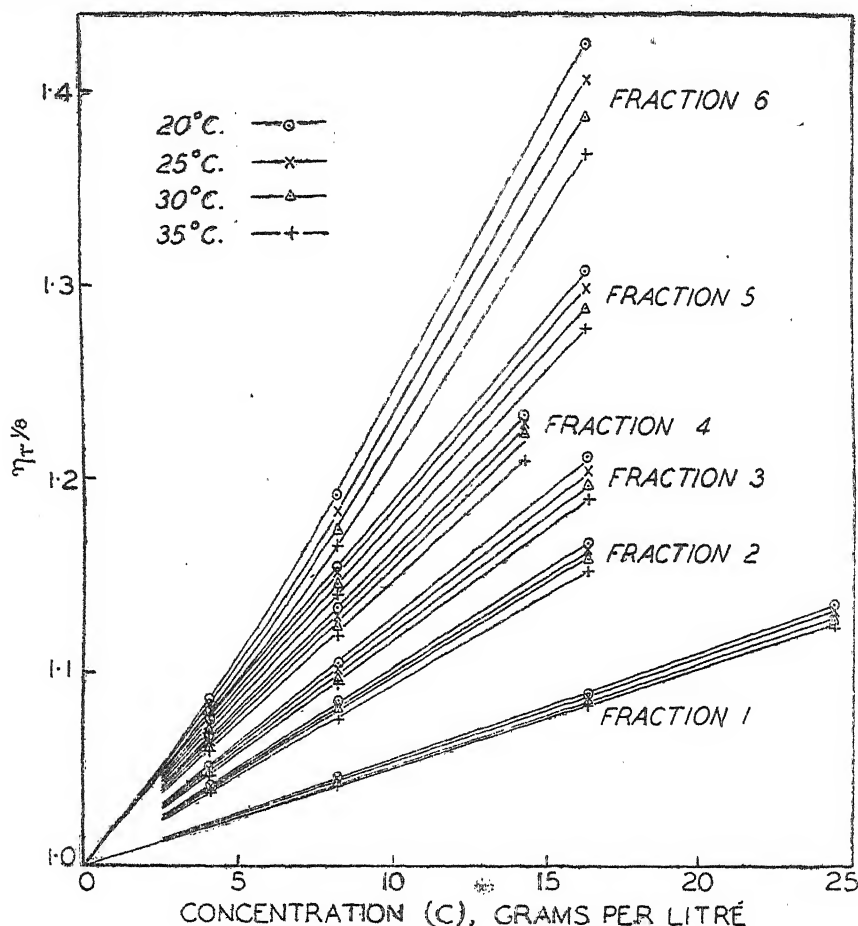


Fig. 9

The agreement between the results of the two series of determinations is excellent whichever method of determining  $[\eta]$  is adopted, such difference as there may be favouring the use of  $\eta_r^{\frac{1}{2}}$  rather than  $\log (\eta_{sp}/c)$ . This agreement is an indication of the excellence of the linear relations, the first values being obtained from viscosities at many concentrations, the second at three only.

The results obtained with the sample of oxidised Seraceta and the fractions prepared from it are given in Table VII. Fig. 9 is a plot of  $\eta_r^{\dagger}$  against  $c$  for the six fractions, the lines for the material from which they were prepared being again omitted to avoid confusion. The lines for fractions 1–5 are straight, but the data for fraction 6 can only be represented by a curve that is distinctly concave upwards. The other plot, of  $\log (\eta_{sp}/c)$  against  $c$ , is shown in Fig. 10; here all the fractions give straight lines, but those for fraction 6 are again anomalous, their slopes being so much greater than those for fraction 5 that the lines cross those of fraction 5 to give lower intercepts on the axis of zero concentration.

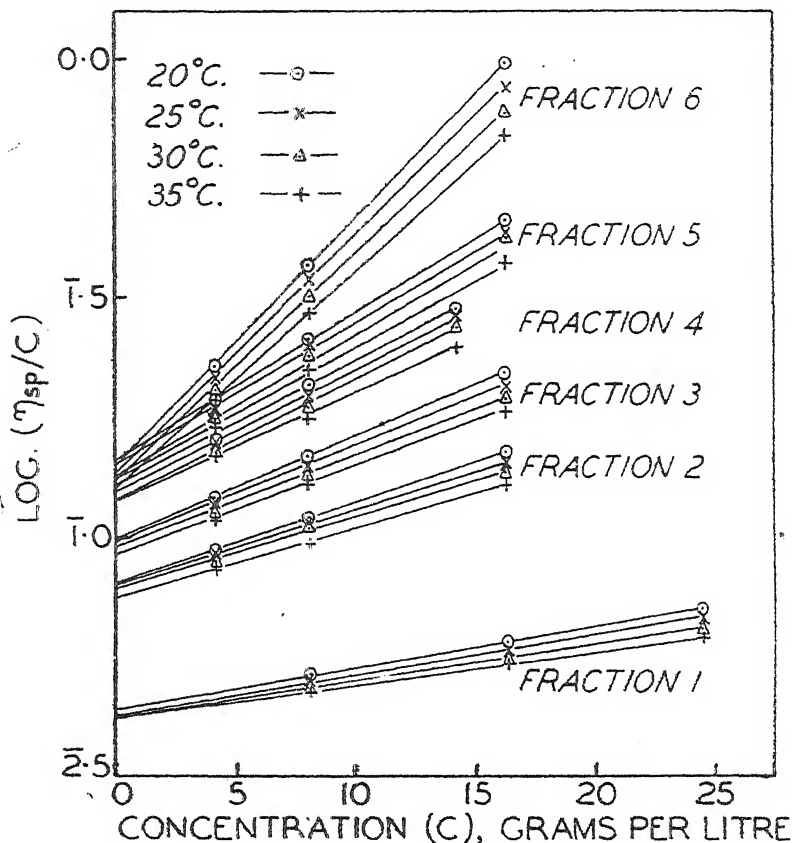


Fig. 10

The values of  $[\eta]$  obtained from these two plots are given in Table VIII. It will be noticed from Fig. 9 that the curves for fraction 6 must in the region of low concentrations be almost identical with the straight lines joining the origin to the points at the lowest concentration; the slopes of the latter have therefore been used to determine  $[\eta]$ . The data for the oxidised Seraceta from which the fractions were extracted also lie on curves (see Fig. 13) that are concave upwards, and the same method has therefore been used to determine the values of  $[\eta]$  for it. In the other method (that using Fig. 10) the linearity of the lines compels the adoption of the normal method of extrapolation, and hence the result is obtained that the intrinsic viscosity of fraction 6 is less than that of fraction 5.

**Table VII**  
**Viscosities of Acetone Solutions of Oxidised Seraceta and its Fractions**  
**at Different Temperatures**

Sample and concentration (grams/litre)				Values of $\eta$ ; centipoises			
				20° C.	25° C.	30° C.	35° C.
Solvent	...	...	0.000	0.322	0.306	0.292	0.280
Oxidised Seraceta	...	...	8.155	0.7314	0.6744	0.6253	0.5820
	...	...	16.31	1.655	1.496	1.352	1.228
	...	...	24.46	3.426	3.035	2.687	2.408
Fraction 1	...	...	8.155	0.4571	0.4302	0.4083	0.3910
	...	...	16.31	0.6375	0.5984	0.5607	0.5348
	...	...	24.46	0.8812	0.8145	0.7553	0.7037
Fraction 2	...	...	4.078	0.4448	0.4213	0.3991	0.3774
	...	...	8.155	0.6089	0.5702	0.5453	0.4995
	...	...	16.31	1.116	1.023	0.9519	0.8700
Fraction 3	...	...	4.078	0.4812	0.4537	0.4276	0.4042
	...	...	8.155	0.7103	0.6600	0.6146	0.5731
	...	...	16.31	1.492	1.347	1.226	1.119
Fraction 4	...	...	4.078	0.5360	0.5051	0.4751	0.4491
	...	...	8.155	0.8746	0.8024	0.7403	0.6853
	...	...	14.27	1.710	1.587	1.456	1.274
Fraction 5	...	...	4.078	0.5763	0.5381	0.5036	0.4751
	...	...	8.155	1.011	0.9456	0.8666	0.7973
	...	...	16.31	2.769	2.477	2.214	1.995
Fraction 6	...	...	4.078	0.6220	0.5766	0.5342	0.5001
	...	...	8.155	1.306	1.174	1.051	0.9477
	...	...	16.31	5.479	4.692	3.986	3.430

**Table VIII**  
**Intrinsic Viscosities of Acetone Solutions of Oxidised Seraceta and**  
**its Fractions, 20-35 °C.**

$$(a) = 8d\eta_{sp}/dc; \quad (b) = \text{antilog} \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$$

Temperature, ° C.	20		25		30		35	
Sample	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Oxidised Seraceta	.106	.099	.102	.095	.098	.091	.094	.087
Fraction 1	.044	.044	.043	.043	.042	.042	.041	.042
Fraction 2	.082	.080	.080	.080	.079	.078	.074	.074
Fraction 3	.102	.099	.099	.098	.096	.095	.092	.091
Fraction 4	.130	.128	.127	.124	.123	.120	.117	.119
Fraction 5	.150	.145	.146	.142	.141	.133	.136	.132
Fraction 6	.168	.141	.162	.136	.154	.130	.148	.126

This implies, of course, that the mean molecular chain length of fraction 6 is less than that of fraction 5, a result that is certainly in error, for the viscosities of solutions of fraction 6 are greater than those of fraction 5 even at the low concentrations at which both lines show a tendency to curve downwards. The data obtained by the other method of determining  $[\eta]$  show no such anomaly, and the absence of the anomaly is not due to the fact that the slope in the low concentration region only was used in the calculation, for if all the data had been used the value of  $[\eta]$  obtained from the slope of the best straight line through all the points would have been still greater than quoted in Table VIII. Here for the first time,



therefore, is definite evidence from the figures themselves that the determination of  $[\eta]$  from the  $\eta_{sp}/c$  plot may be preferable to that using  $\log(\eta_{sp}/c)$ .

It should be mentioned that the data provided in Tables V and VII all give straight lines when the logarithm of the viscosity of any of the solutions is plotted against the reciprocal of the absolute temperature; the temperature range covered is, however, small, and hence the data plotted in Fig. 6 provide more reliable evidence of the linearity of this relation. It is of interest to note that over the range of chain lengths covered by these fractions there is no tendency for the temperature effect to change direction with increasing molecular weight, as was suggested by Burgers.<sup>19</sup>

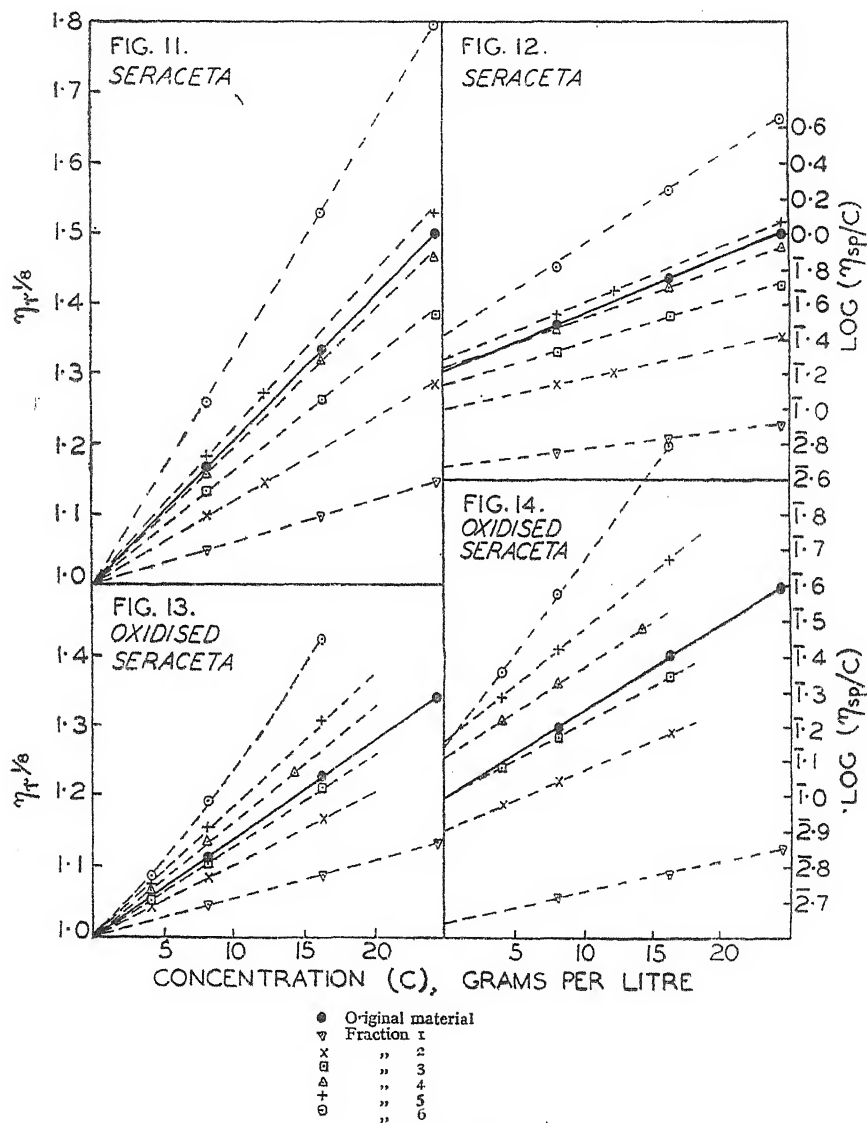
### (c) The Effect of Heterogeneity

Although data for the original Seraceta and oxidised Seraceta are included in Tables V and VII it proved impossible to include these data in Figs. 7-10 without confusing the whole picture. Figs. 11-14 have therefore been prepared to permit a comparison of the results obtained from the original materials with those from the various fractions into which they were subdivided, attention being confined to one temperature only. Fig. 11 shows  $\eta_{sp}/c$  plotted against concentration for Seraceta and its fractions at 20°C. The line for the original Seraceta falls naturally into place among those for the various fractions, its slope indicating a value of  $[\eta]$  between those for fractions 4 and 5 (Table VI). On Fig. 12  $\log(\eta_{sp}/c)$  is plotted against  $c$ , and there it will be noticed that the line for the original Seraceta cuts across those for the fractions, with a slope abnormally large for its position in the series. As a result of this the value of  $[\eta]$  obtained by extrapolation lies between those of fractions 3 and 4 (Table VI), though all the points on the line lie between the corresponding points for fractions 4 and 5. A similar effect is observed in Figs. 13 and 14, where the data for the oxidised Seraceta are similarly plotted. It will be noted that the line obtained by plotting  $\eta_{sp}/c$  against  $c$  for the oxidised Seraceta is, like that for fraction 6, concave upwards (Fig. 13). The slope near the origin is a little greater than that for fraction 3, and hence gives a slightly greater value of  $[\eta]$  (Table VIII), but on the  $\log(\eta_{sp}/c)$  plot (Fig. 14) the slope of the line for the oxidised Seraceta is sufficiently great to bring down the value of  $[\eta]$  to one identical with that of fraction 3 (Table VIII), in spite of the fact that at all concentrations examined the viscosities of the material as a whole are greater than those of fraction 3 prepared from it.

Table IX  
Intrinsic Viscosities of Seraceta and Oxidised Seraceta, 20-35°C.

		20° C.	25° C.	30° C.	35° C.
Seraceta					
$[\eta] = 8d\eta_{sp}/dc$	Observed ... ..	·164	·158	·152	·146
	Calculated from values for fractions...	·155	·149	·144	·138
$[\eta] = \text{antilog} \lim_{c \rightarrow 0} \log(\eta_{sp}/c)$	Observed ... ..	·162	·156	·149	·142
	Calculated from values for fractions...	·160	·152	·149	·138
Oxidised Seraceta					
$[\eta] = 8d\eta_{sp}/dc$	Observed ... ..	·106	·102	·098	·094
	Calculated from values for fractions...	·105	·102	·099	·094
$[\eta] = \text{antilog} \lim_{c \rightarrow 0} \log(\eta_{sp}/c)$	Observed ... ..	·099	·095	·091	·087
	Calculated from values for fractions..	·099	·097	·093	·091

The essential difference between the original material and its fractions is one of heterogeneity of molecular chain length, the material being a very intimate mixture of the various fractions. The fractions themselves will not of course be homogeneous with respect to chain length, but at least they are much more homogeneous than the material from which they were prepared. It would appear, therefore, that heterogeneity has no effect on



Figs. 11-14

the  $\eta_r/c$  plot, but on the  $\log (\eta_{sp}/c)$  plot confers on the line a slope appreciably greater than that of a more homogeneous material of the same intrinsic viscosity.

According to the Staudinger equation the intrinsic viscosity is linearly related to the molecular weight by means of a constant that is independent

of the molecular weight. If this assumption is justified then it follows that since the molecular weight is a strictly additive property the intrinsic viscosity should be also; that is, the intrinsic viscosity of the original material should be calculable from those of its various fractions by taking a mean, weighted according to the proportions in which the fractions are present. Values obtained in this way are given in Table IX. The agreement between observed and calculated values is reasonably good throughout, though considerably less good for the values obtained for Seraceta by the use of the plot of  $\eta_r^{\frac{1}{2}}$  than for any of the others. No explanation of this is at present available. It will be noted that excellent agreement is obtained by the use of the  $\log (\eta_{sp}/c)$  plot, in spite of the fact that some of the individual results involved in the comparison are, as has been mentioned above, distinctly anomalous. Taken as a whole the figures support Staudinger's contention that there is a unique relation between  $[\eta]$  and molecular weight, at any rate over the range of molecular weight covered by these materials.

#### (d) The Effect of Solvent

Staudinger has shown<sup>20, 22, 23</sup> that different values of  $[\eta]$  are obtained for a given cellulose derivative according to the solvent used; only a few solvents were examined by him, however, and a further examination of the magnitude of this effect was considered desirable.

The viscosities of solutions in various solvents of Seraceta and a triacetate prepared from it by non-degradative acetylation<sup>44</sup> were determined at 20°C. The results of these determinations are presented in Tables X and XI. As before, straight lines varying in slope are obtained when  $\eta_r^{\frac{1}{2}}$  is plotted against  $c$ , and a plot of  $\log (\eta_{sp}/c)$  against  $c$  gives a series of lines varying both in slope and in the intercept on the axis of zero concentration, the variation in slope being sufficient to cause crossing of some of the lines.

Table X  
Viscosities of Seraceta in Various Solvents at 20°C.

Solvent and concentration (grams/litre)	$\eta$ centi- poises	$\eta_r$	$\eta_r^{\frac{1}{2}}$	$\log_{10}(\eta_{sp}/c)$	$8d\eta_r^{\frac{1}{2}}/dc$	Antilog $\lim_{c \rightarrow 0} \log (\eta_{sp}/c)$
Acetone (From Table I)					-164	-163
Dioxane ...	0.000	1.280	1.000	1.000	—	-173
	11.43	7.685	6.004	1.251	I-6413	
	16.54	14.81	11.57	1.358	I-8055	
	26.68	47.04	36.75	1.569	0.1271	
Pyridine ...	0.000	0.9727	1.000	1.000	—	-139
	3.943	1.662	1.709	1.069	I-2546	
	5.928	2.130	2.190	1.103	I-3026	
	6.923	2.389	2.456	1.119	I-3229	
<i>m</i> -Cresol ...	0.000	17.37	1.000	1.000	—	-166
	2.169	24.83	1.430	1.046	I-2967	
	3.940	32.45	1.868	1.081	I-3431	
	6.232	45.03	2.592	1.126	I-4074	
Methylene chloride (70 parts) ethyl alcohol (30 parts) by volume	0.000	0.5116	1.000	1.000	—	-144
	4.385	0.9397	1.837	1.079	I-2807	
	5.277	1.070	2.092	1.097	I-3156	
	8.061	1.491	2.914	1.143	I-3756	
	10.49	2.011	3.931	1.187	I-4462	

**Table XI**  
**Viscosities of Seraceta Triacetate in Various Solvents at 20°C.**

Solvent and concentration (grams/litre)		$\eta$ centi- poises	$\eta_r$	$\eta_r^{\frac{1}{2}}$	$\log_{10}(\eta_{sp}/c)$	$8d\eta_r^{\frac{1}{2}}/dc$	Antilog { $\lim_{c \rightarrow 0} \log(\eta_{sp}/c)$ }
Chloroform	0.000	0.5738	1.0000	1.0000	—	-089	-092
	7.139	1.063	1.8526	1.0801	1.0771		
	9.262	1.257	2.1907	1.1030	1.1091		
	11.05	1.445	2.5183	1.1224	1.1380		
	14.55	1.879	3.2747	1.1598	1.1941		
<i>m</i> -Cresol	0.000	17.37	1.0000	1.0000	—	-114	-126
	3.631	26.46	1.5233	1.0540	1.1587		
	7.678	39.89	2.2965	1.1095	1.2275		
	11.42	55.89	3.2176	1.1573	1.2882		
Methylene chloride (70 parts), ethyl alcohol (30 parts) by volume	0.000	0.5121	1.0000	1.0000	—	-110	-113
	2.516	0.6750	1.3181	1.0351	1.1019		
	4.985	0.8688	1.6965	1.0683	1.1453		
	11.36	1.595	3.1146	1.1526	1.2698		

The values of  $[\eta]$  obtained with these solvents and with acetone show that there is quite a large variation of  $[\eta]$  according to the solvent used. Measurements were also made on a sample of viscose rayon that had been acetylated non-degradatively to the triacetate; *m*-cresol and chloroform were used as solvents, and the results presented in Table XII show that here also the intrinsic viscosity varies with the solvent.

**Table XII**  
**Viscosities of Acetylated Viscose Rayon in *m*-Cresol and Chloroform at 20°C.**

Solvent and concentration (grams/litre)		$\eta_r$	$\eta_r^{\frac{1}{2}}$	$\log_{10}(\eta_{sp}/c)$	$8d\eta_r^{\frac{1}{2}}/dc$	Antilog { $\lim_{c \rightarrow 0} \log(\eta_{sp}/c)$ }
<i>m</i> -Cresol	4.278	1.856	1.0804	1.3012	-148	-161
	5.701	2.231	1.1055	1.3343		
	7.938	2.917	1.1432	1.3829		
Chloroform	6.262	2.050	1.0939	1.2245	-118	-127
	7.877	2.407	1.1161	1.2519		
	11.69	3.490	1.1691	1.3284		

This variation is also shown by the data of Table XVI, which gives the intrinsic viscosities of a series of cellulose acetates having acetic acid yields between those of secondary cellulose acetate and cellulose triacetate; the detailed results obtained with these materials are given in the succeeding section.

Solvents composed of two liquids in varying proportions have also been used; the results given in Table XIII show that the intrinsic viscosities of Seraceta in mixtures of acetone and water do not vary with the amount of water present (within the range of composition examined), though they are appreciably lower than the values obtained for solutions in pure acetone (0.1640 and 0.1626). In addition, it can be shown graphically that the relative viscosities are also independent of solvent composition. These results are similar to Staudinger's observations on acetone-water solutions of cellulose nitrate.<sup>10</sup> The values of  $[\eta]$  obtained from the  $\log(\eta_{sp}/c)$  plot are more irregular than those from the  $\eta_r^{\frac{1}{2}}$  plot, but it appears to be random irregularity, without any definite trend. It may be noted that although the relative and intrinsic viscosities are independent of the water content of the solvent the absolute viscosities of both solvent and solution were found to increase continuously as the water content of the solvent is increased.

Table XIII  
Viscosities of Seraceta in Acetone-Water Mixtures at 20°C.

Per cent. acetone by volume	$c$	$\eta_r$	$\eta_r^{\frac{1}{2}}$	$\log_{10}(\eta_{sp}/c)$	$8d\eta_r^{\frac{1}{2}}/dc$	Antilog { $\lim_{c \rightarrow 0} \log(\eta_{sp}/c)$ }
97.5	3.985	1.8051	1.0766	I.3055	-155	.152
	7.723	3.0441	1.1493	I.4227		
	11.53	5.0147	1.2233	I.5418		
95.0	4.039	1.8490	1.0799	I.3226	-156	.164
	5.985	2.4362	1.1177	I.3802		
	7.769	3.0570	1.1499	I.4229		
	11.58	4.9597	1.2216	I.5340		
90.0	4.155	1.8603	1.0807	I.3161	-153	.159
	8.155	3.1945	1.1562	I.4299		
	11.81	4.9753	1.2221	I.5271		
85.0	4.061	1.8523	1.0801	I.3220	-154	.164
	7.776	3.0336	1.1488	I.4175		
	11.54	4.7920	1.2164	I.5167		
80.0	3.915	1.8004	1.0763	I.3106	-153	.162
	5.585	2.2649	1.076	I.3550		
	9.162	3.5578	1.1719	I.4459		
	11.07	4.5261	1.2077	I.5031		

Results of viscosity determinations on solutions of Seraceta and its triacetate in mixtures of methylene chloride and ethyl alcohol are given in Table XIV. Again it is found that the relative and intrinsic viscosities of the solutions do not vary with the composition of the solvent within the range studied, though the absolute viscosities of the solvents and the solutions increase with increasing alcohol content.

Table XIV  
Viscosities of Seraceta and Seraceta Triacetate in Methylene Chloride-Ethyl Alcohol Mixtures at 20°C.

Ratio of methylene chloride to alcohol by volume	$c$	$\eta_r$	$\eta_r^{\frac{1}{2}}$	$\log_{10}(\eta/_{sp}c)$	$8d\eta_r^{\frac{1}{2}}/dc$	Antilog { $\lim_{c \rightarrow 0} \log (\eta_{sp}/c)$ }
Seraceta						
65 : 35	3.723	1.6862	1.0675	I.2656	-143	.148
	7.386	2.6896	1.1316	I.3594		
	11.31	4.2483	1.1982	I.4582		
70 : 30	4.385	1.8370	1.0790	I.2808	-144	.150
	5.277	2.0926	1.0967	I.3161		
	8.061	2.9148	1.1431	I.3757		
	10.49	3.9333	1.1867	I.4466		
75 : 25	4.439	1.8465	1.0797	I.2803	-142	.148
	7.832	2.7795	1.1363	I.3677		
	11.24	4.1772	1.1957	I.4513		
Seraceta triacetate						
65 : 35	3.847	1.5276	1.0544	I.1372	-109	.118
	7.700	2.2172	1.1047	I.1989		
	11.49	3.1172	1.1527	I.2654		
70 : 30	2.516	1.3185	1.0352	I.1024	-110	.113
	4.985	1.6963	1.0683	I.1451		
	11.36	3.1148	1.1526	I.2699		
75 : 25	4.170	1.5591	1.0571	I.1274	-110	.111
	6.247	1.9567	1.0875	I.1851		
	9.986	2.3717	1.1359	I.2490		

Table XV. Viscosities in Various Solvents of Cellulose Acetates of Different Acetic Acid Yields at 20°C.

Acetone			Pyridine			Chloroform			Methylene chloride (70 parts), ethyl alcohol (30 parts), by volume		
Acetic acid yield per cent.	Concentra- tion, grams/litre	$\eta$	Acetic acid yield per cent.	Concentra- tion, grams/litre	$\eta$	Acetic acid yield per cent.	Concentra- tion, grams/litre	$\eta$	Acetic acid yield per cent.	Concentra- tion, grams/litre	$\eta$
54.1	4.040	1.837	46.0	3.631	1.654	57.0	8.470	2.539	53.8	4.385	1.837
"	7.932	3.207	"	4.285	1.793	"	11.44	3.621	"	5.277	2.092
"	11.51	3.124	"	4.877	1.926	"	16.15	5.888	"	8.061	2.915
"	—	—	"	5.832	2.126	"	18.77	7.816	"	10.49	3.931
"	—	—	"	6.670	2.395	"	—	—	"	—	—
57.0	5.095	2.138	47.0	3.469	1.572	57.3	4.201	1.584	54.1	3.980	1.801
"	10.535	4.410	"	3.708	1.635	"	8.188	2.391	"	7.754	2.929
"	13.68	6.419	"	4.955	1.900	"	10.88	3.078	"	11.39	4.403
"	—	—	"	6.763	2.345	"	15.11	4.745	"	—	—
"	—	—	"	—	—	"	18.27	6.259	"	—	—
57.3	4.254	1.877	52.3	3.800	1.671	58.3	8.061	2.390	57.5	4.246	1.726
"	7.231	2.773	"	5.608	2.101	"	9.232	2.713	"	7.800	2.614
"	9.018	3.468	"	7.745	2.706	"	11.09	3.452	"	11.67	4.003
"	11.80	4.906	"	—	—	"	12.17	3.724	"	—	—
"	—	—	"	—	—	"	14.84	5.032	"	—	—
57.5	4.977	2.042	53.8	3.216	1.545	58.6	5.023	1.702	59.4	4.239	1.611
"	5.362	2.158	"	5.077	1.973	"	10.32	2.845	"	8.054	2.386
"	6.863	2.596	"	5.754	2.101	59.4	3.424	1.402	"	11.92	3.362
"	8.100	3.042	"	7.463	2.606	"	7.700	2.017	"	—	—
"	11.15	4.528	"	—	—	"	14.88	3.576	"	—	—
58.3	3.816	1.764	57.5	3.854	1.643	60.8	8.054	1.970	60.8	4.101	1.563
"	6.092	2.355	"	4.740	1.804	"	22.29	5.285	"	6.378	1.948
"	10.51	4.034	"	6.016	2.076	"	23.23	5.740	"	7.814	2.215
"	—	—	"	7.663	2.524	"	—	—	"	11.68	3.115
58.6	5.635	2.239	58.3	3.524	1.557	64.5	7.139	1.856	—	—	—
"	6.387	2.479	"	5.077	1.879	"	9.262	2.191	—	—	—
"	15.025	6.889	"	7.132	1.367	"	11.05	2.519	—	—	—
"	—	—	"	—	—	"	14.55	3.276	—	—	—

## (e) The Effect of Acetic Acid Yield

The results given in the previous section have already shown that Seraceta and the triacetate obtained from it by non-degradative acetylation have quite different intrinsic viscosities even when these are determined in the same solvent. The only difference between the two materials after they have been dissolved in the solvent is that of acetic acid yield, and it was therefore considered desirable to investigate the effect of this variable in greater detail. Samples with acetic acid yield varying from 46 to 62.5 were therefore prepared from Seraceta by the methods of non-degradative acetylation and de-acetylation previously described, and their viscosities in several solvents were determined. These viscosities are given in Table XV, and intrinsic viscosities determined by the methods previously used are given in Table XVI. Owing to the wide range of their acetic acid yields, the samples exhibited considerable differences in solubility and it was impossible to determine the viscosities of all the samples in one solvent, but the different series overlap sufficiently to show that the intrinsic viscosity decreases as the acetic acid yield increases. This trend is most pronounced when the solvent is a mixture of methylene chloride and ethyl alcohol, and relatively small when acetone is used.

Table XVI  
Intrinsic Viscosities of Cellulose Acetates of Different Acetic Acid Yields, at 20°C.

$$(a) = 8d\eta_{sp}/dc; (b) = \text{antilog} \lim_{c \rightarrow 0} \log (\eta_{sp}/c)$$

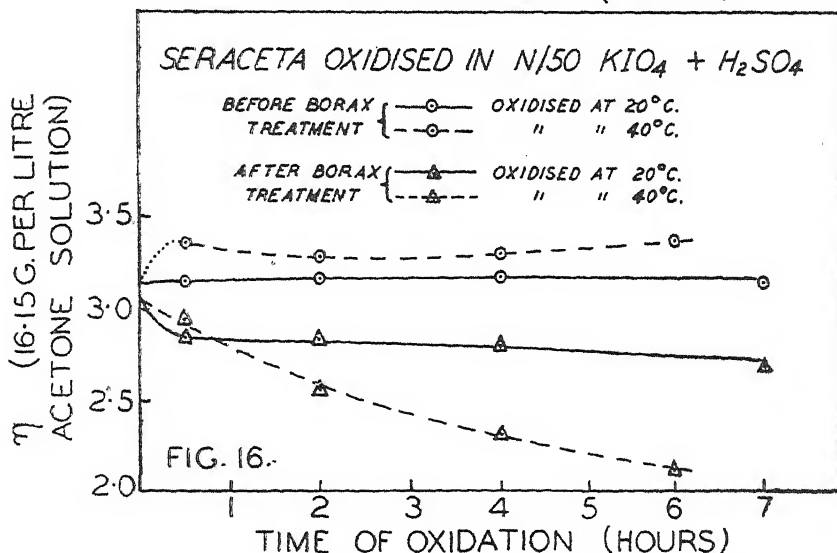
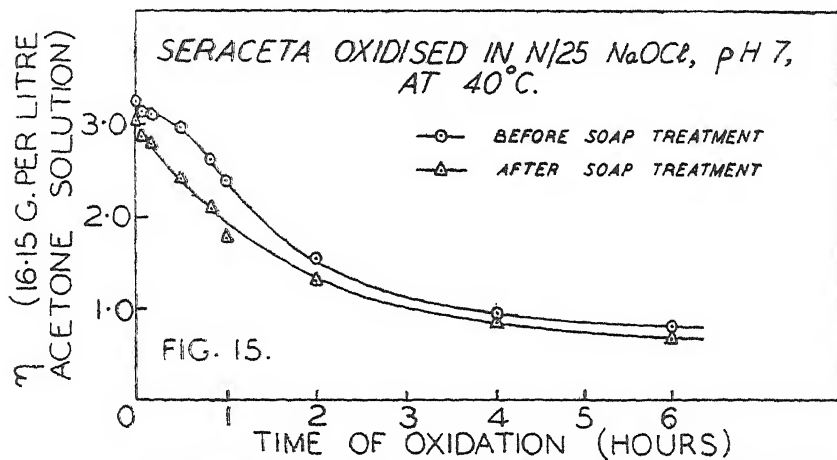
Solvent	Acetone		Pyridine		Chloroform		Methylene chloride 70 parts, ethyl alcohol 30 parts by volume	
Acetic acid yield, percent.	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
46.0	—	—	.140	.155	—	—	—	—
47.0	—	—	.135	.138	—	—	—	—
52.3	.159	.157	.138	.143	—	—	—	—
53.8	.164	.163	.138	.147	—	—	.144	.150
54.1	.157	.155	—	—	—	—	.148	.163
57.0	.155	.159	—	—	.122	.107	—	—
57.3	.151	.157	—	—	.113	.111	—	—
57.5	.149	.152	.129	.139	—	—	.131	.135
58.3	.149	.161	.129	.131	.118	.102	—	—
58.6	.149	.156	—	—	.109	.111	—	—
59.4	—	—	—	—	.104	.104	.112	.120
60.8	—	—	—	—	.086	.090	.108	.119
62.5	—	—	—	—	.089	.092	.110	.113

## (f) The Effect of Oxidation

In Table VIII are given the intrinsic viscosities of a sample of oxidised Seraceta and fractions prepared from it, and the effect of the oxidation may be assessed by comparing the figures there given with those for unoxidised Seraceta presented in Table VI. It will be seen that the main effect is a large decrease of the intrinsic viscosity of the unfractionated material (from 0.164 to 0.106), an even larger decrease of the intrinsic viscosity of the highest fraction (from 0.258 to 0.168), and scarcely any alteration of the value for the lowest fraction (0.047 to 0.044).

The oxidised sample referred to above had been prepared by treating Seraceta for two hours at 40°C. in N/25 sodium hypochlorite solution buffered at pH7, treatment at pH7 being necessary to prevent hydrolysis and to secure a fair degree of oxidation in a reasonable time because cellulose acetate is highly resistant to oxidation. It has been shown,<sup>47</sup> however,

that the oxidation of cellulose in non-alkaline media causes some of the bonds adjacent to the points of attack to be so alkali-sensitive that they are broken, with consequent shortening of the molecular chains, on treatment with very dilute alkali. This behaviour has been ascribed<sup>48</sup> to oxidation occurring at two adjacent hydroxyl groups, and it was obviously of interest to enquire if cellulose acetate rayon behaved similarly, since with most of the hydroxyl groups esterified it seemed unlikely that the distribution of those remaining would permit the frequent occurrence of two such groups



Figs. 15 and 16

on adjacent carbon atoms of the chain-molecules. A difficulty arises here in that the dilute alkaline solutions ordinarily used to demonstrate the existence of these alkali-sensitive bonds rapidly de-acetylate acetate rayon. In the first experiments made in this connection the samples were boiled in 0.7 per cent. soap solution for  $1\frac{1}{2}$  hours, but almost immediately a treatment for  $1\frac{1}{2}$  hours in M/20 borax at 97°C. was substituted, and has been used since. Even this treatment is by no means ideal, for it probably does cause a small amount of superficial de-acetylation, but it is good enough for the immediate purpose.



Fig. 15 shows the viscosities in acetone solution at 20°C. of samples of Seraceta oxidised in N/25 sodium hypochlorite, pH7, at 40°C. for times up to six hours, before and after the soap treatment described. There is a definite reduction of viscosity following the soap treatment, and to enhance this potassium periodate in sulphuric acid was tried as the oxidising agent, Davidson<sup>49</sup> having shown that on cellulose this reagent is considerably more effective than neutral hypochlorite in producing the type of oxidation under consideration. The continuous curves of Fig. 16 show the effect of oxidation at 20°C. in N/50 potassium periodate acidified with sulphuric acid; the viscosity before the borax treatment is practically unchanged by the oxidation, whilst that after the treatment shows a steady though small fall. The experiment was repeated with the temperature of oxidation increased to 40°C., and the discontinuous curves of Fig. 16 show the results obtained. The fall of viscosity following the borax treatment is much more pronounced, but the viscosities of the oxidised samples before the treatment are *greater* than that of the unoxidised material. (These experiments are the first in which a rise of viscosity following oxidation was noticed). A still more

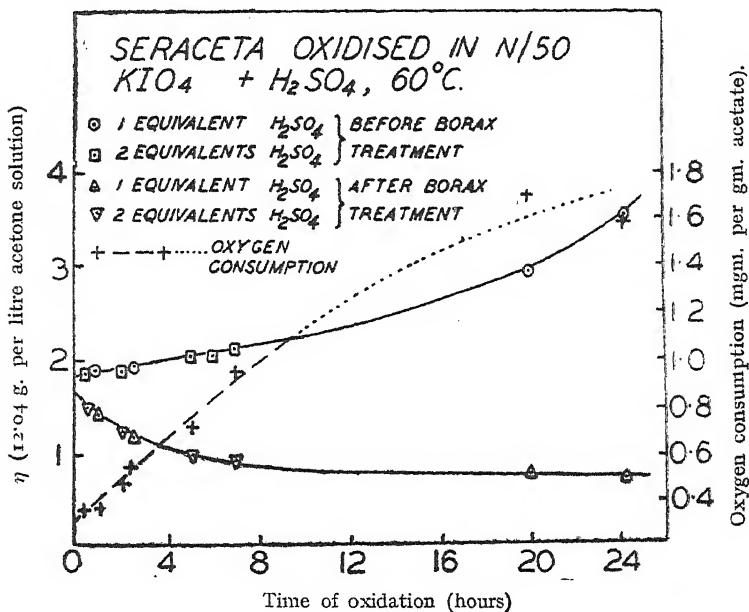


Fig. 17

vigorous oxidation was next tried, the temperature being increased to 60°C., and the time to 24 hours, with the results shown in Fig. 17. The rise of viscosity is here very pronounced, the viscosity of the sample oxidised for 24 hours being nearly double that of the original material, though after the borax treatment the same sample has a viscosity only half that of unoxidised Seraceta. (It is of course possible that the specific character of the oxidation is not retained at the rather high temperatures employed here).

In the above experiments no evidence was obtained that periodate oxidation might cease after a certain point, as might have been expected if the occurrence of two hydroxyl groups on adjacent carbon atoms of the chain was infrequent. (It had already been found that these solutions had no appreciable oxidising action on cellulose triacetate, so that possible oxidation of the acetyl groups could be neglected). It was at first considered that the failure to reach an end-point might be due to a general slowing

down of the reaction caused by at least some of the chains being accessible to the reagent only with difficulty, and attempts were made to oxidise the material while it was in a highly swollen condition. Since the swelling of cellulose acetate is to a large extent reversible this meant oxidising in the presence of a swelling agent, and the attempts were unsuccessful because no swelling agent that was itself unaffected by periodic acid was found. To overcome this difficulty attempts were made to oxidise Seraceta dissolved in aqueous pyridine by  $N/12$  periodic acid at  $25^{\circ}\text{C.}$  and  $N/50$  periodic acid

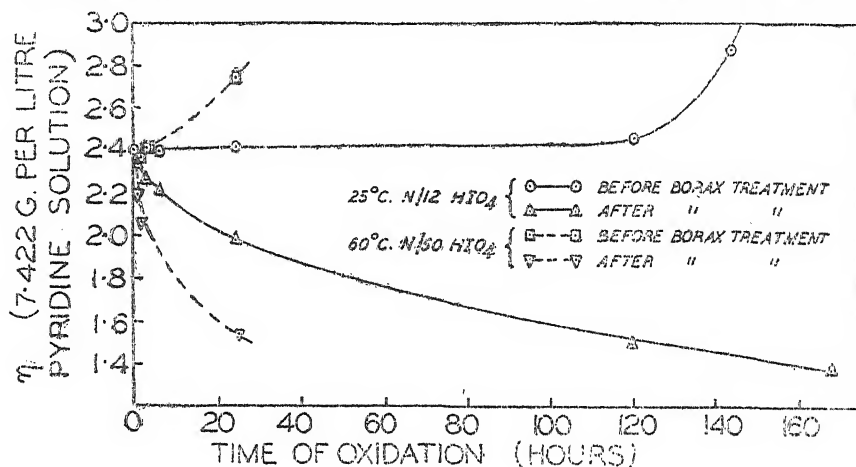
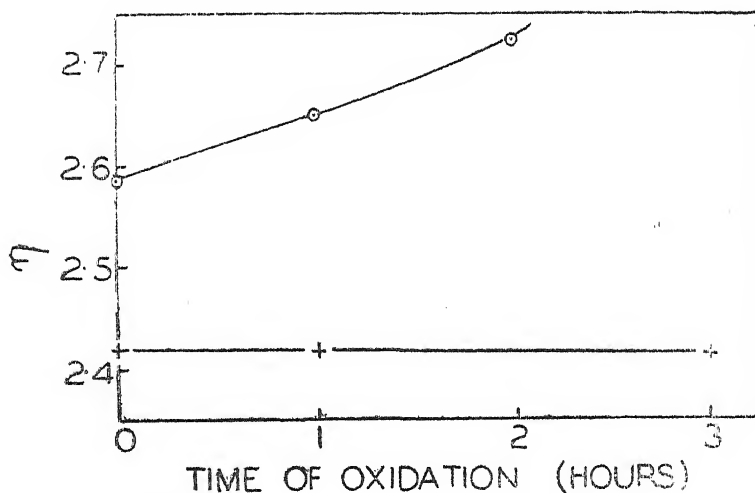


Fig. 18



+ Seraceta  
 O Hydrolysed Seraceta  
 Oxidised  $N/50$   $\text{HIO}_4$   $60^{\circ}\text{C.}$   
 (Viscosity measured on pyridine solutions, 7.422 gm. per litre.)

Fig. 19

at  $60^{\circ}\text{C.}$ , but the substance had no oxidising action in these solutions. Comparable experiments with periodic acid in aqueous solution were run at the same time to obtain data for the corresponding heterogeneous oxidation. The results of these are shown in Fig. 18; they are similar to those previously obtained with periodate, showing a rise of viscosity before the alkaline treatment, and a fall of viscosity after it.

Another method was tried to elucidate the effect of the number of hydroxyl groups. A sample of Seraceta was hydrolysed to an acetic acid yield of 46 per cent. by the method of homogeneous non-degradative

de-acetylation previously referred to; the hydrolysed material, like the original, was soluble in pyridine. Both were oxidised in N/50 aqueous periodic acid at 60°C. for periods up to 24 hours. Of the oxidised samples only those treated for periods not greater than 2 hours were soluble in pyridine, and none of the borax-treated samples would dissolve. The results of viscosity determinations on those samples that would dissolve are given in Fig. 19. Though severely limited in scope, they show that the increase of viscosity is much more pronounced for the hydrolysed than for the unhydrolysed material.

The frequency of occurrence of two adjacent hydroxyl groups can be calculated on the assumption that these groups are randomly distributed among the possible points of attachment. There are three such points per glucose unit, but only when one of the three possible pairs of points are occupied will the hydroxyl groups be on neighbouring atoms of the chain. The probability of finding two hydroxyl groups in juxtaposition is therefore essentially the probability of filling a *specified* two out of three positions. If the number of hydroxyl groups available per glucose unit is  $n$  then this probability is  $(n/3)^2$ . The number  $n$  is related to the acetic acid yield  $A$  per cent. by the relation

$$n = \frac{3000 - 48A}{1000 - 7A}$$

and for a secondary acetate of acetic acid yield 53.8,  $n$  has the value 0.67. The probability of the occurrence of hydroxyl on two neighbouring atoms of the molecular chain is therefore  $(0.67/3)^2$ , or 0.05. This corresponds to a frequency of occurrence of about once in every twenty glucose units. This is a good deal more frequent than had been thought likely at first, and no other explanation is needed to account for the failure to reach an "end-point" in the oxidation process, the mean chain length of the most highly oxidised sample being of the order of at least 100 glucose units after treatment with borax solution.

The increases of viscosity caused by oxidation are most probably due to association through the  $-\text{CHO}$  groups formed during the oxidation. At any rate association through  $-\text{COOH}$  groups seems unlikely, for the increase of viscosity was also found in dioxane solution, and there is some evidence<sup>50</sup> that bonds between  $-\text{COOH}$  groups are broken down in the presence of dioxane. It is clear that in using viscosity data to determine the molecular weight of oxidised samples, the possibility that association may occur must not be neglected, otherwise entirely erroneous results might be obtained.

#### IV. THE EVALUATION OF THE INTRINSIC VISCOSITY AND THE DETERMINATION OF CHAIN LENGTH

The previous sections have shown the effects of some of the factors that influence the viscosity of solutions of cellulose acetates. These effects have been summarised by the evaluation of the intrinsic viscosity, two methods having been used to determine this quantity. Although these methods were based on the linear relationships between  $\eta_{r^{\frac{1}{3}}}$  and  $c$  on the one hand and  $\log \eta_{sp}/c$  and  $c$  on the other, the graphs themselves were not used to determine  $[\eta]$ , algebraic methods being preferred in order to eliminate personal bias in the placing of the lines. There are two obvious methods of determining  $[\eta] = 8d\eta_{r^{\frac{1}{3}}}/dc$  apart from orientating the best straight line among the points by eye. The first is to determine the mean values of  $\eta_{r^{\frac{1}{3}}}$  and  $c$  as  $\bar{\eta}_{r^{\frac{1}{3}}}$  and  $\bar{c}$ , and to set  $(\bar{\eta}_{r^{\frac{1}{3}}} - 1)/\bar{c} = d\eta_{r^{\frac{1}{3}}}/dc$ ; the second is to evaluate  $(\eta_{r^{\frac{1}{3}}} - 1)/c$  for each of the experimental points, and to take the mean value of this function as  $d\eta_{r^{\frac{1}{3}}}/dc$ . In general the experimental points are so close to the best straight line among them that it makes very little difference which method is adopted, but the latter has been preferred since the former tends to give greater weight to the observations at higher

concentrations, where the linearity of the relationship is more in doubt. The principle adopted in determining  $\lim_{c \rightarrow 0} \log (\eta_{sp}/c)$  was to use the method of zero sum to substitute two points for the experimental points however many in number, and to determine algebraically the intercept on the axis of zero concentration of the straight line through these points. Actually, it is of course unnecessary to determine the coordinates of the substitute points, the following formulae being applicable according to the number of experimental points available ( $\bar{y}$  denotes  $\lim_{c \rightarrow 0} \log (\eta_{sp}/c)$  and  $y_1, y_2 \dots y_n$  the experimental values of  $\log \eta_{sp}/c$  at concentrations  $c_1, c_2, \dots c_n$ ).

(a) Two experimental points

$$\bar{y} = \frac{c_2 y_1 - c_1 y_2}{c_2 - c_1}$$

(b) Three experimental points

$$\bar{y} = \frac{1}{3} \left[ \frac{2c_3 + c_2}{c_3 - c_1} y_1 + y_2 - \frac{2c_1 + c_2}{c_3 - c_1} y_3 \right]$$

(c) Four experimental points

$$\bar{y} = \frac{1}{2} \left[ \frac{(c_3 + c_4)(y_1 + y_2) - (c_1 + c_2)(y_3 + y_4)}{(c_3 + c_4) - (c_1 + c_2)} \right]$$

(d) Five experimental points

$$\bar{y} = \frac{1}{5} \left[ \frac{c_3 + 2c_4 + 2c_5}{(c_4 + c_5) - (c_1 + c_2)} (y_1 + y_2) + y_3 - \frac{2c_1 + 2c_2 + c_3}{(c_4 + c_5) - (c_1 + c_2)} (y_4 + y_5) \right]$$

The values of  $[\eta]$  given in previous tables were obtained by these methods except (a) where it has been indicated that the lines are curved, and (b) in three instances where an experimental point was so far from the straight line defined by the other observations as to be obviously erroneous.

As indicated in the Introduction, there is a large amount of evidence that the intrinsic viscosity  $[\eta]$  is linearly related to the molecular weight and hence the molecular chain length of the dissolved substance. In this work it is more convenient to use the chain length expressed in glucose units, because this eliminates the effect of variations in the acetic acid yield of the materials used, which of course cause alteration of molecular weight even when the chain length remains constant. The Staudinger equation is therefore used in the form

$$[\eta] = K_m l$$

where  $[\eta]$  is the intrinsic viscosity,  $l$  is the chain length in glucose units, and  $K_m$  is the factor relating the one to the other. Whilst there is little doubt about the correctness of this equation (the possibility that a constant term<sup>43</sup> has been omitted need not be considered since there is no means of testing it so far as these data are concerned), there is quite a large amount of doubt about the correct numerical value of  $K_m$  for any given material under specified conditions. For this reason, and since none of the materials examined in this work has as yet had its chain length determined by a method to which no exception can be taken, the authors have preferred to choose from the various values given in the literature one that they considered reasonably probable, to use that value to determine the chain length of the material, and from that chain length to calculate other values of  $K_m$  corresponding to the other conditions under which the same material, or other material of identical chain length, was examined. These values of  $K_m$  were then used to determine the chain lengths of other materials of different chain length and since these were usually also examined under several conditions a fair amount of cross-checking could be done. In this way a system of self-consistent values is obtained which may, however, be in error in an absolute sense; it is hoped that work in progress will eventually lead to a rigorous check of the values now suggested.

Examination of the results obtained reduced the number of possible reference points for this scheme to two, involving the use of the intrinsic viscosity of either (a) cellulose triacetate in chloroform or (b) secondary cellulose acetate in acetone. The former has the advantage that the substance used is of more definite composition, so that differences due to variations of acetic acid yield could not introduce error. On the other hand, its use would involve the acceptance of the value of  $K_m$  proposed by Staudinger<sup>23, 24</sup> for this system ( $5.3 \times 10^{-4}$ ) which is based on molecular weights determined osmotically. This would give a number-average molecular weight for the heterogeneous material examined, which would not be comparable with the weight-average molecular weight that is related to the viscosity, and hence would be unsuitable for comparing the chain length of a material with those of fractions prepared from it. (The weight-average molecular weight could, however, be calculated from the number-average if the distribution of chain lengths about the mean were known.) Secondary cellulose acetate is admittedly a less definite material, but its solutions in acetone have been given more detailed study than any of the other systems so that its intrinsic viscosity is known with greater accuracy, and it has the advantage that a value of  $K_m$  can be obtained on the basis of molecular weights determined by means of the ultracentrifuge. This second system has therefore been chosen, and a value of  $K_m$  of  $4.3 \times 10^{-4}$  has been calculated from Kraemer's<sup>42</sup> work on cellulose acetates of chain lengths varying between 190 and 950. (This value is less than half that obtained for this system by using as reference point Staudinger's value of  $5.3 \times 10^{-4}$  for cellulose triacetate in chloroform, and consequently the chain lengths here calculated are rather more than twice those obtained by using the Staudinger figure. This difference emphasizes the necessity of regarding the calculated chain lengths as relative only until the values for some of the materials can be determined by a more rigorous method.) By applying the value  $4.3 \times 10^{-4}$  to the intrinsic viscosities 0.1640 and 0.1626 calculated from  $\eta_i^{\frac{1}{2}}$  and  $\log (\eta_{sp}/c)$ , respectively, the corresponding values of the chain length of Seraceta were found (from the formula  $l = [\eta]/K_m$ ) to be 381 and 378. These chain lengths were then used to determine the values of  $K_m$  for Seraceta in other solvents, with the results given in Table XVII. (In this and subsequent Tables the values of  $K_m$  are given to two places of decimals in order to indicate any general trends; there is of course no implication that they can be used to determine chain lengths to a comparable degree of accuracy).

Table XVII  
Values of  $K_m$  for Seraceta in Various Solvents

(a) Calculated from  $[\eta] = 8d\eta_r/k'dc$ ; (b) Calculated from  $[\eta] = \text{antilog} \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$ .

(All  $K_m$  values have been multiplied by  $10^4$ )

Solvent	(a)	(b)
Acetone 100    Water 0    ... ..	4·3	4·3
"     97·5   "     2·5    ... ..	4·05	4·01
"     95·0   "     5·0    ... ..	4·08	4·34
"     90·0   "     10·0   ... ..	4·01	4·22
"     85·0   "     15·0   ... ..	4·03	4·34
"     80·0   "     20·0   ... ..	4·00	4·27
Methylene chloride 65, Ethyl alcohol 35    ... ..	3·74	3·95
"                 "     70,   "     "     30    ... ..	3·78	3·97
"                 "     75,   "     "     25    ... ..	3·72	3·92
Dioxane    ...    ...    ...    ...    ...    ...	4·53	5·01
Pyridine    ...    ...    ...    ...    ...    "	3·65	3·87
m-Cresol    ...    ...    ...    ...    ...    ...	4·34	4·56

Table XVIII

Values of  $K_m$  in Various Solvents, for Samples of Different Acetic Acid Yields Derived from Seraceta(a) Calculated from  $[\eta] = 8d\eta_r^3/dc$ , assuming  $l = 381$ .(b) Calculated from  $[\eta] = \text{antilog} \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$ , assuming  $l = 378$ .(All  $K_m$  values have been multiplied by  $10^4$ )

Acetic acid yield, per cent.	Acetone		Pyridine		Chloroform		Methylene chloride 65 parts, Ethyl alcohol 35 parts, by volume		Methylene chloride 70 parts, Ethyl alcohol 30 parts, by volume		Methylene chloride 75 parts, Ethyl alcohol 25 parts, by volume		<i>m</i> -Cresol	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
46.0	—	—	3.66	4.07	—	—	—	—	—	—	—	—	—	—
47.0	—	—	3.53	3.66	—	—	—	—	—	—	—	—	—	—
52.3	4.17	4.14	3.63	3.78	—	—	—	—	—	—	—	—	—	—
53.8	4.3	4.3	3.62	3.90	—	—	3.74	3.95	3.77	3.97	3.72	3.92	4.34	4.56
54.1	4.13	4.09	—	—	—	—	—	—	3.88	4.32	—	—	—	—
57.0	4.06	4.22	—	—	3.17	2.83	—	—	—	—	—	—	—	—
57.3	3.95	4.15	—	—	2.95	2.94	—	—	—	—	—	—	—	—
57.5	3.91	4.03	—	—	—	—	—	—	3.44	3.57	—	—	—	—
58.3	3.91	4.03	3.39	3.67	3.09	2.70	—	—	—	—	—	—	—	—
58.6	3.90	4.12	3.37	3.47	2.85	2.93	—	—	—	—	—	—	—	—
59.4	—	—	—	—	2.73	2.74	—	—	2.94	3.18	—	—	—	—
60.8	—	—	—	—	2.26	2.39	—	—	2.82	3.14	—	—	—	—
62.5	—	—	—	—	2.33	2.43	2.87	3.12	2.87	2.99	2.89	2.93	3.00	3.32

Similarly,  $K_m$  values can be calculated for cellulose triacetate and other acetates of different acetic acid yield, it having been shown that the acetylation and de-acetylation processes used in preparing these materials from Seraceta have not caused any change of chain length; these values are given in Table XVIII.

All viscosity measurements subsequent to those in the initial general survey were made at 20°C., and consequently the  $K_m$  values corresponding to other temperatures are of no direct interest so far as the ultimate purpose of this work is concerned. However, a useful test of the self-consistency of the results can be made by determining the  $K_m$  values for samples of Seraceta at 20, 25, 30 and 35°C., and using these values to determine the chain lengths of the Seraceta fractions, of the sample of oxidised Seraceta, and of its fractions; the chain lengths so determined should of course be independent of temperature. The  $K_m$  values referred to are given in Table XIX and the calculated chain lengths obtained by using them in Table XX. The chain lengths are in fact constant within the limits of error of chain length determination, though it is apparent that the degree of constancy is appreciably greater when they are calculated from  $[\eta]$  determined on the basis of the  $\eta_r^{\frac{1}{2}}$  plot than when  $\log (\eta_{sp}/c)$  is used.

Table XIX  
Values of  $K_m$  for Seraceta at 20, 25, 30 and 35°C.  
(All  $K_m$  values have been multiplied by  $10^4$ ).

Temperature, °C.	...	...	...	20	25	30	35
$K_m$ determined from $[\eta] = 8d\eta_r^{\frac{1}{2}}/dc$ , assuming $l = 381$ ...	...	...	...	4.30	4.14	3.99	3.83
$K_m$ determined from $[\eta] = \text{antilog}$ $\lim_{c \rightarrow 0} \log (\eta_{sp}/c)$ , assuming $l = 378$ ...	...	...	...	4.28	4.12	3.94	3.74

Table XX  
Chain Lengths of Seraceta, Oxidised Seraceta, and their Fractions, calculated  
from Viscosity Determinations at 20, 25, 30 and 35°C.

Sample		Chain length determined from $[\eta] = 8d\eta_r^{\frac{1}{2}}/dc$ at:				Chain length determined from $[\eta] = \text{antilog}$ $\lim_{c \rightarrow 0} \log (\eta_{sp}/c)$ at:			
		20°C.	25°C.	30°C.	35°C.	20°C.	25°C.	30°C.	35°C.
Seraceta fractions	...	1	110	111	112	114	108	111	113
		2	219	219	220	222	230	228	231
		3	298	300	300	300	317	317	318
		4	362	362	363	364	395	389	392
		5	409	410	409	410	439	436	435
		6	601	599	597	597	595	583	577
Oxidised Seraceta	...	...	247	246	246	245	231	230	231
Oxidised Seraceta fractions	...	1	102	103	104	107	102	104	108
		2	190	193	197	194	186	193	199
		3	238	240	240	241	231	237	240
		4	302	307	308	306	298	301	304
		5	349	353	353	354	339	344	338
		6	392	390	385	385	330	331	330

The sum of the squares of the deviations from the group means is 33 for the chain lengths of Seraceta derived from  $\eta_r^{\frac{1}{2}}$  and 329 for the chain lengths derived from  $\log (\eta_{sp}/c)$ ; similarly for the sample of oxidised Seraceta and its fractions the corresponding values are 119 and 688.

Another check can be made by calculating the chain lengths of the viscose triacetate for which the intrinsic viscosities in chloroform and *m*-cresol are given in Table XII. The calculations have been made with

the aid of the appropriate  $K_m$  values taken from Table XVIII, and the results are given in Table XXI. All the values are reasonably consistent, but the difference between the two values obtained from  $\log (\eta_{sp}/c)$  is appreciably greater than that between the values obtained from  $\eta_r^{\frac{1}{2}}$ .

Table XXI  
Chain Length of Acetylated Viscose

Solvent	$[\eta] = 8d\eta_r^{\frac{1}{2}}/dc$	$K_m \times 10^4$	Chain length	$\left\{ \begin{array}{l} [\eta] = \text{Antilog} \\ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \end{array} \right\}$	$K_m \times 10^4$	Chain length
m-Cresol ...	·148	3·00	493	·161	3·32	485
Chloroform ...	·118	2·33	506	·127	2·43	523

Sufficient evidence has now been obtained to justify a decision on the preferred method of calculating the intrinsic viscosity  $[\eta]$ , from the experimental viscosity data; this evidence may be summarized as follows :—

(1) The plot of  $\eta_r^{\frac{1}{2}}$  against  $c$  is usually linear down to the lowest concentrations examined; the plot of  $\log (\eta_{sp}/c)$  against  $c$  may be non-linear at low concentrations, all the experimental points at such concentrations being on one side of the straight line defined by the data at higher concentrations. On the other hand the  $\eta_r^{\frac{1}{2}}$  plot is occasionally curved (e.g., Fig. 9) at the concentrations normally used, where the  $\log (\eta_{sp}/c)$  plot is completely linear.

(2) Although the plot of  $\eta_r^{\frac{1}{2}}$  against  $c$  for fraction 6 of the sample of oxidised Seraceta is non-linear (Fig. 9), its use provides a more reasonable value of the intrinsic viscosity than the straight line of the  $\log (\eta_{sp}/c)$  plot, which indicates that the intrinsic viscosity of fraction 6 is less than that of fraction 5 (Table VIII).

(3) The difference between the values of the intrinsic viscosity of Seraceta determined (a) from viscosity measurements on the material itself, and (b) by calculation from the intrinsic viscosities of its fractions is appreciably less when  $[\eta]$  is determined from  $\log (\eta_{sp}/c)$  than when  $\eta_r^{\frac{1}{2}}$  is used. On the other hand for the sample of oxidised Seraceta the use of  $\eta_r^{\frac{1}{2}}$  gives values at least as concordant as does the use of  $\log (\eta_{sp}/c)$ .

(4) The data of Table XIII show that the intrinsic viscosity of Seraceta in mixtures of acetone and water does not vary with variations of water content between 2·5 and 20 per cent., but the random variation is greater when  $[\eta]$  is determined from  $\log (\eta_{sp}/c)$  than when  $\eta_r^{\frac{1}{2}}$  is used.

(5) The irregularity in the chain lengths recorded in Table XX is considerably greater when they are calculated from  $\text{antilog } \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$  than when they are calculated from  $8d\eta_r^{\frac{1}{2}}/dc$ .

(6) The difference between the two determinations of the chain length of the acetylated viscose (Table XXI), is smaller if  $8d\eta_r^{\frac{1}{2}}/dc$  is used in preference to  $\text{antilog } \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$ .

The balance of the above evidence is unquestionably in favour of the determination of  $[\eta]$  as  $8d\eta_r^{\frac{1}{2}}/dc$  rather than  $\text{antilog } \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$  and an *a priori* examination of the methods themselves, altogether apart from the results they provide, leads to the same conclusion. The determination of  $[\eta]$  as  $\text{antilog } \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$  is essentially an extrapolation, and the value of  $[\eta]$  obtained is very sensitive to the way the line is orientated among the experimental points. On the other hand the determination of  $[\eta]$  as  $8d\eta_r^{\frac{1}{2}}/dc$  is an interpolation, so that the possible variation in  $[\eta]$  determined from a given set of data is strictly limited. Moreover, the use of the latter method provides an additional point on the graph ( $c=0$ ,  $\eta_r^{\frac{1}{2}}=1$ ), positioned with absolute accuracy.

This method will therefore be used in later papers of this series for determining the intrinsic viscosity  $[\eta]$  and hence the chain length. Values



of  $K_m$  appropriate to this method of calculation are given in Table XXII for the various materials and solvents used. These have been rounded off for actual use in calculating chain lengths.

Table XXII  
Values of  $K_m$  for Cellulose Acetates in Various Solvents at 20° C.  
(All  $K_m$  values have been multiplied by 10<sup>4</sup>)

Acetic acid yield, per cent.	Acetone	Acetone- water (2.5-20% water)	Pyridine	Methylene chloride/ Ethyl alcohol			Dioxane	<i>m</i> -Cresol	Chloro- form
				65/35	70/30	75/25			
46.0	—	—	3.6	—	—	—	—	—	—
47.0	—	—	3.6	—	—	—	—	—	—
52.3	4.3	—	3.6	—	—	—	—	—	—
53.8	4.3	4.0	3.6	3.7	3.7	3.7	4.5	4.3	—
54.1	4.1	—	—	—	3.7	—	—	—	—
57.0	4.1	—	—	—	—	—	—	—	3.1
57.3	4.0	—	—	—	—	—	—	—	3.1
57.5	3.9	—	3.4	—	3.4	—	—	—	—
58.3	3.9	—	3.4	—	—	—	—	—	3.1
58.6	3.9	—	—	—	—	—	—	—	2.8
59.4	—	—	—	—	2.9	—	—	—	2.7
60.8	—	—	—	—	2.9	—	—	—	2.3
62.5	—	—	—	2.9	2.9	2.9	—	3.0	2.3

The self-consistency of these values is to some extent indicated by the data for chain lengths given in Table XXIII for various cellulosic materials. This Table shows the chain lengths of a series of cellulose acetates determined from (a) the viscosities of solutions of the acetates in acetone and (b) the viscosities of solutions in chloroform of triacetates prepared from these acetates by non-degradative acetylation (with the exception of one sample, which, with an acetic yield of 56.2 per cent., was soluble in both acetone and chloroform). The  $K_m$  values for acetone and chloroform are those given in Table XXII; these of course correspond to a chain length of 381 for Seraceta. The chain lengths derived from measurements of viscosities in the different solvents are reasonably concordant, the greatest discrepancy being about 5 per cent. They therefore encourage the hope that the methods adopted and the  $K_m$  values derived may be used to determine with some accuracy the relative chain lengths of different cellulosic materials and of fractions prepared from them, whatever correction may have to be applied later to obtain results of greater absolute accuracy.

Table XXIII  
Chain Lengths of Cellulose Acetates

Solvent:—			Acetone				Chloroform			
Sample			$[\eta]$	Acetic acid yield per cent.	$K_m$	Chain length	$[\eta]$	Acetic acid yield per cent.	$K_m$	Chain length
Seraceta	...	...	1640	53.8	4.3	381	0888	62.5	2.3	381
Celanese	...	...	178	52.6	4.3	415	092	62.5	2.3	396
Lansil	...	...	156	52.7	4.3	364	083	62.5	2.3	356
Rhodiaceta	...	...	168	53.4	4.3	391	091	61.7	2.3	391
Hercules, Acetate	...	...	166	53.0	4.3	385	—	—	—	—
Hercules PM3, Acetate	...	...	151	51.3	4.3	351	—	—	—	—
Hercules, High-acetyl acetate	...	...	169	56.2	4.1	412	132	56.2	3.2	412
Eastman, Acetate	...	...	154	51.2	4.3	359	—	—	—	—

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## APPENDIX\*

ON THE RELATION BETWEEN THE  $\eta_{sp}$  AND LOG ( $\eta_{sp}/c$ ) PLOTS(i) Determination of  $[\eta]$  from the  $\eta_{sp}$  Plot.

In this paper two methods have been used for determining  $[\eta] = \lim_{c \rightarrow 0} \eta_{sp}/c$ , one based on the linear relation between  $\eta_{sp}$  and  $c$ , the other on the linear relation between  $\log (\eta_{sp}/c)$  and  $c$ . These relations are expressible algebraically as follows:—

\*The authors acknowledge with gratitude the assistance of H. A. Standing, Ph.D., of the Shirley Institute, in this work.

$$\begin{aligned}
 (1) \quad \eta_r &= (1 + pc)^8 \\
 (2) \quad \log_{10} (\eta_{sp}/c) &= a'c + b' \\
 \log_e (\eta_{sp}/c) &= ac + b, \quad \text{where } a = 2.3026 a' \text{ and } b = 2.3026 b' \\
 \eta_{sp}/c &= e^{ac+b} \\
 \text{and } [\eta] &= \lim_{c \rightarrow 0} \eta_{sp}/c = e^b \\
 \text{But } \eta_{sp} &= \eta_r - 1 \\
 \text{where } \eta_r &= (1 + pc)^8 \\
 \therefore \eta_{sp} &= (1 + pc)^8 - 1 \\
 \therefore \lim_{c \rightarrow 0} \eta_{sp}/c &= \lim_{c \rightarrow 0} \frac{(1 + pc)^8 - 1}{c}
 \end{aligned}$$

Putting  $c = 0$ , this is of the form  $0/0$ . Hence differentiate numerator and denominator and take limits:

$$\begin{aligned}
 \frac{d}{dc} [(1 + pc)^8 - 1] &= 8p(1 + pc)^7 \\
 \therefore \lim_{c \rightarrow 0} \eta_{sp}/c &= \lim_{c \rightarrow 0} \frac{8p(1 + pc)^7}{1} = 8p \\
 \text{i.e., } [\eta] &= 8p, \text{ where } p \text{ is the slope of the } \eta_r^{\frac{1}{8}} \text{ plot.} \\
 \text{From these two values of } [\eta] \text{ it is clear that } e^b &= 8p.
 \end{aligned}$$

### (ii) Correlation of the two Equations.

The equation  $\eta_{sp}/c = e^{ac+b}$  can be written in the form  $\eta_r = 1 + ce^{ac+b}$ , and since the experimental data are also expressible by the relation

$$\begin{aligned}
 \eta_r &= (1 + pc)^8 \\
 \text{we have the identity } (1 + pc)^8 &= 1 + ce^{ac+b} \\
 \text{i.e., } (1 + pc)^8 &= 1 + e^b ce^{ac}
 \end{aligned}$$

If this equation is an identity the coefficients of  $c^n$  on each side of the equation must be equal. But the left-hand side has no terms of power greater than 8 in  $c$ , whilst the right-hand side has; the equation cannot therefore be a true identity. If, however,  $ac$  is small the terms  $\frac{(ac)^9}{9!}$  etc., can be neglected, in which case the equation may be regarded as an identity.

In these circumstances we have

$$(1 + pc)^8 = 1 + e^b c \left[ 1 + ac + \frac{(ac)^2}{2} + \frac{(ac)^3}{3!} + \frac{(ac)^4}{4!} + \dots + \frac{(ac)^8}{8!} \right]$$

Comparing coefficients of  $c$ , we have

$8p = e^b$ , identical with the result given in (i) above. Substituting in the above equation, we have

$$(1 + pc)^8 = 1 + 8pc \left[ 1 + ac + \frac{(ac)^2}{2} + \frac{(ac)^3}{3!} + \dots + \frac{(ac)^8}{8!} \right]$$

Comparing coefficients of  $c^2$ ,  $a = 3.50p$

„ „ „  $c^3$ ,  $a = 3.74p$

„ „ „  $c^4$ ,  $a = 3.74p$

„ „ „  $c^5$ ,  $a = 3.60p$

„ „ „  $c^6$ ,  $a = 3.55p$

„ „ „  $c^7$ ,  $a = 2.99p$

„ „ „  $c^8$ ,  $a = 2.51p$

The lack of agreement between the various values of  $a$  is of course due to the fact that the equation is not a true identity, but there is reasonable agreement up to coefficients of  $c^5$ , the values being

$$a = 3.50p, 3.74p, 3.74p, \text{ and } 3.60p.$$

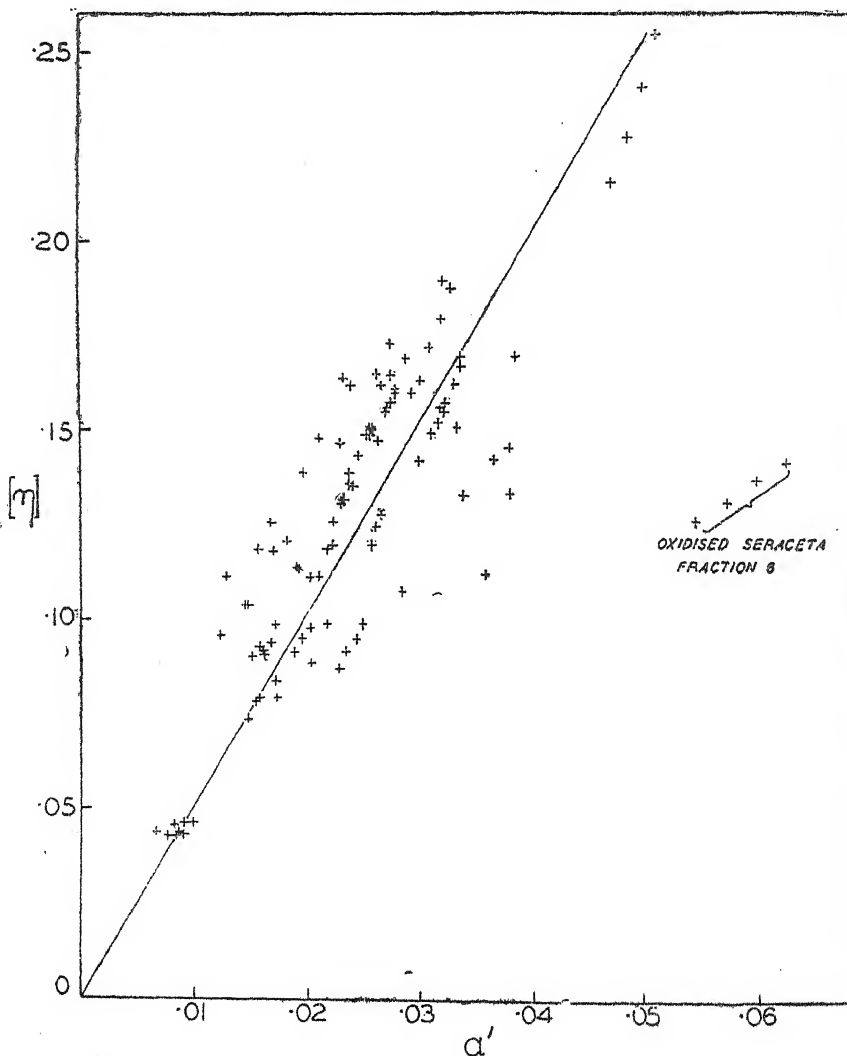
giving a mean value of  $a = 3.64p$ .

### (iii) The Relation of the Constants.

From the exact equation  $[\eta] = e^b = 8p$  and the approximate one  $a \approx 3.64p$  we have  $[\eta] = e^b = 8p = 8a/3.64 = 8 \times 2.3026a'/3.64$ , i.e.,  $[\eta] = 5.1 a'$

It would appear, therefore, that there is a unique relation between the zero intercept ( $b' = \text{antilog } [\eta]$ ) and the slope ( $a'$ ) of the  $\log (\eta_{sp}/c)$  plot, so that  $[\eta]$  should be calculable from either.

The extent to which this deduction is in agreement with observation will be evident from Fig. 20, in which  $[\eta] = \text{antilog} \left\{ \lim_{c \rightarrow 0} \log (\eta_{sp}/c) \right\}$  is plotted against  $a'$ , the slope of the  $\log (\eta_{sp}/c)$  line. The straight line on this diagram is that representing the relation deduced above,  $[\eta] = 5.1a'$ , whilst the points are those for practically all the systems mentioned in the paper. The scatter of the points is fairly large, but this is not surprising in view of the fact that a slight difference in the orientation of the line on the  $\log (\eta_{sp}/c)$  plot produces a large change in  $[\eta]$ . The only set of data that is widely displaced is that for fraction 6 of the oxidised Seraceta, and here agreement is not expected since the data do not yield straight lines when  $\eta_{sp}^{1/2}$  is plotted against  $c$ . The experimental points refer to many widely different systems—secondary cellulose acetates of several kinds, other acetates of acetic acid yield varying from 46 to 62.5, dissolved in pure and mixed solvents differing widely in constitution, at several temperatures—and the figure may therefore be regarded as confirmation of the deduction that for systems which give linear relations between  $c$  and both  $\eta_{sp}^{1/2}$  and  $\log (\eta_{sp}/c)$  the slope and the zero intercept of the  $\log (\eta_{sp}/c)$  plot do not vary independently, but are related by the equation given above.

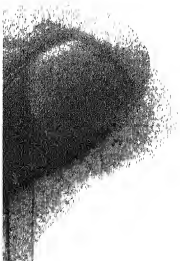


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## ABSTRACTS

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### 1—FIBRES AND THEIR PRODUCTION

#### (C)—VEGETABLE

**Bobshaw Cotton: Characteristics.** H. B. Brown. *J. Amer. Soc. Agron.*, 1943, 35, 24; (through *Plant. Breed. Abstr.*, 1943, 13, 345). Bobshaw, a selection from Stoneville cotton made at Heathman, Miss., is a medium-early cotton, but only moderately resistant to wilt. Its fibre qualities are "superior." C.

**Cotton: Grade; Influence of Varietal Differences.** H. B. Brown and C. B. Haddon. *J. Amer. Soc. Agron.*, 1943, 35, 249-255 (through *Plant. Breed. Abstr.*, 1943, 13, 346). The results of experiments are tabulated to show the effect of the variety on the grade of lint in cotton. Among the six varieties studied there was a significant difference of half a grade between the values for the highest and the lowest varieties. C.

**Egyptian Cotton: Improvements in Production.** C. H. Brown. *Textile Weekly*, 1943, 32, 667-8, 715-6. The writer summarizes recent trends in the production of Egyptian cotton under the headings (1) Improvements in yield per acre, (2) Varietal changes, (3) Grade improvement, and (4) Variety deterioration. C.

**Sea Island Cotton Strain: Yield.** *Sth. Seedsman*, 1943, 6, No. 4, 41 (through *Plant Breed. Abstr.*, 1943, 13, 345). Mention is made of an improved strain, Z-10, of the Old Seabrook variety of Sea Island cotton, which in tests at Florida Agricultural Experiment Station has given a good yield. C.

**Upland Cotton: Inheritance of Green Fuzz, Fibre Length and Fibre Length Uniformity.** J. O. Ware, W. H. Jenkins and D. C. Harrell. *J. Amer. Soc. Agron.*, 1943, 35, 382-392 (through *Plant. Breed. Abstr.*, 1943, 13, 345-346).  $F_1$  and  $F_2$  generations and first generation back-crosses were obtained from

Florida Green Seed  $\times$  Rowden. The genetics of fuzz colour was investigated. The  $F_1$  showed a narrow colour range intermediate between the deep green of Florida Green Seed and the pure white of Rowden. In the  $F_2$  an almost complete series of colour variation was found, excepting the pure white, which did not reappear; the back-crosses showed less extensive colour ranges. Fibre length was also investigated. The longer values were incompletely dominant in the  $F_1$  and a unimodal distribution of lengths appeared in the  $F_2$ . The back-cross with Florida Green Seed reduced the fibre length below the  $F_1$  mean but the Rowden back-cross did not produce a corresponding increase, perhaps owing to a rather shorter fibre length in the Rowden plant used. A slight association between green colour and shorter fibre length was discovered. C.

**Cotton Plant: Varietal Resistance to Wilt.** 54th Ann. Rept. Agric. Exp. Sta. Univ. Tennessee, 1941, 100 pp. (through *Plant Breed. Abstr.*, 1943, 13, 306). Varietal resistance to wilt (*Fusarium*) is more precisely estimated from the number of plants killed than from the number affected. Although strains of the fungus have been isolated with varying degrees of virulence no differential resistance by the varieties to these strains has been observed. Coker 4-in-1 came out best in varietal tests for wilt resistance and crossing has been effected between wilt-resistant varieties and Upland cotton strains. C.

**Cotton Rust Fungus: Characteristics.** J. T. Presley and C. J. King. *Phytopathology*, 1943, 33, 382-389 (through *Rev. Appl. Mycol.*, 1943, 22, 385-386). The causal organism of cotton rust in Arizona and Texas, previously referred to *Puccinia boutelouae* differs from that and all species heretofore described on *Bouteloua* in the presence in its uredospores of three equatorial pores instead of several scattered ones, and is accordingly designated *P. stakmanii* n. sp. A detailed description of this fungus is given. The pycnidial and aecidial stages are found in nature on the leaves and stems of *Gossypium barbadense* and *G. hirsutum*, and the uredo- and teleutosori on *B. rockrothii*. In greenhouse inoculation experiments all the cultivated cotton varieties represented in *G. barbadense*, *G. hirsutum*, and *G. hopi* were classed as susceptible; *G. arboreum* was mildly susceptible; eight out of ten wild cotton species were mildly susceptible and one susceptible; and five other Malvaceae resistant. Four out of five species of *Bouteloua* tested were susceptible and one mildly so, whilst eight species of *Muhlenbergia* and nine of *Sporobolus* were resistant. In normal seasons the moderate amount of defoliation caused by *P. stakmanii* does not seriously impair the health of the plants, but the severe attacks coinciding with frequent rains and high relative humidity in the late summer or early autumn may result in the shedding of most of the leaves and many of the bolls. Fields have been observed in which the incidence of infection reached 100 per cent. and more than half the effective leaf surface of the plants was destroyed or damaged. The alternate grass hosts of the rust in or on the borders of irrigated cotton plantations commonly grow much larger and produce more inoculum than the desert-grown specimens dependent on rainfall; hence some degree of control may be achieved by clean cultural practices both within and along the borders of the fields. C.

**Cotton Seed: Disinfection.** K. S. Chester and W. W. Ray. *Circ. Oklahoma agric. Exp. Sta.* C-109, 8 pp. 1943 (through *Rev. Appl. Mycol.*, 1943, 22, 386). The authors discuss the importance of seed disinfection in Oklahoma, particularly for the control of angular leaf spot. The most useful treatment under local conditions is that with "new improved cerasan," but alternatives are suggested. Suitable dosages are indicated. The seed should be stored in a fairly air-tight container for 24 to 48 hours after being treated. When treated seed is used the sowing rate may be reduced by one-third without impairing the stand. Seed may be treated from one day to a year before sowing. Directions are given for making a metal drum seed treater and one of the box type. C.

**Cotton Bollworms: Occurrence in the Central Provinces and Berar, India.** G. R. Dutt, M. S. Patel and K. R. Sontakay. *Indian J. Agric. Sci.*, 1943, 13, 1-17. Observations made in three successive seasons, 1934-37, indicate that the spotted bollworm (*Earias fabia* Stoll.), the pink bollworm (*Platyedra gossypiella* Saund.), and the American bollworm (*Heliothis obsoleta* Fabr.) cause considerable damage to the cotton crop in the Central Provinces and Berar. The nature and extent of this damage is discussed, and observations of the life-history and habits of the bollworms and the methods of carry-over are recorded. Spotted bollworm is carried over from one season\* to another by alternative

food plants such as *H. esculentus*, *H. panduriformis*, *H. sabdarifa*, *Abutilon*, hollyhock, and perennial and stray cotton plants. *Kapas* of late pickings harbours pink bollworm larvae, but the practice of selling it away before summer and the severe heat of the season make it difficult for the pest to carry-over. Pink bollworm larvae do not hibernates in cotton seed to the extent necessary to carry infection to the next year. Cotton stalks stored for fuel and stray cotton plants and tree cotton harbour pink bollworm larvae. Early removal of cotton stalks after the last picking, elimination of stray cotton plants and tree cotton, and the disposal of all *kapas* before May are recommended for the prevention of serious damage by the pink bollworm. C.

**Peruvian Cotton Exports, 1942-43.** *Bd. Trade J.*, 1943, 149, 431. During the complete 12 months (August to July) of the 1942-43 season, exports of cotton from Peru aggregated 142,238 bales of 478 lb. net, as compared with 222,207 bales in the 1941-42 season, there having been no shipments to Japan this season whereas the figure in 1941-42 was 60,071 bales; exports to the United States have also been much lower. The principal destinations for Peruvian cotton during the 1942-43 crop-year, with the comparable figures for the 1941-42 season given in parentheses, were as follows: Great Britain, 46,366 bales (39,603); Chile, 38,963 (32,051); Columbia, 23,821 (23,199); Cuba, 8,071 (nil); Bolivia, 6,512 (8,429); Argentina, 5,689 (5,904); Sweden, 3,442 (2,694); the United States, 3,292 (33,972); Ecuador, 3,150 (1,715); Mexico, 2,198 (nil); Uruguay, 649 (346); Panama, 61 (652), and Brazil, 24 (nil). C.

**Mercurial Fungicidal Dust: Vapour Action.** S. G. Lehman. *Phytopathology*, 1943, 33, 431-448 (through *Chem. Abstr.*, 1943, 37, 5544<sup>1</sup>). Ceresan, New Improved Ceresan, ethyl mercury borate, and ethyl mercury iodide emit fungicidally active vapours, which act as a fumigant fungicide for cotton seeds. C.

**Cotton Harvesting Machinery: Costing.** R. Garcia-Mata and R. A. Franchelli. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 93, 15-22. A report is given of tests with a mechanical harvester of the type having revolving teeth. Costs of mechanical harvesting are compared with those of hand picking, and the influence on costs of such factors as size of plantation, hours of use of the machine and variety of cotton are discussed. It is estimated that under typical Argentine conditions the cost of production per ton of cotton could be reduced by about 12.4 per cent. by the use of mechanical harvesting in place of hand picking. This would also solve the problem of the scarcity of labour available for cotton picking in the Republic. C.

#### (D)—ARTIFICIAL

**Pulp and Paper: Treatment with Fungicides and Germicides.** D. K. Ballmann and F. B. Smith. *Paper Ind.*, 1943, 25, 143-148 (through *Rev. Appl. Mycol.*, 1943, 22, 413-414). The immersion of pulp logs in 1 per cent. solutions of "dowicide" G or S eliminates sap stain due to various organisms and decreases the loss of cellulose resulting from infection by the "dry-rot" group of organisms. The treatment of lap stock is best performed at the wet press, where a solution of dowicide F (sodium 2:4:5:6-tetrachlorophenate) is sprayed on the sheet. Dowicide G (sodium pentachlorophenate) is not quite such an effective fungicide, but where freedom from residual chemical odour is a consideration it may be substituted for F at a slightly stronger concentration. The souring of pulp in the system during shut-down periods is a sequel to the action of bacteria and moulds, which may usually be obviated by the addition of 2 lb. dowicide G per ton of pulp. The same preparation may be employed in the washing of felts during shut-downs at the rate of 2 to 4 lb. per 50 gal. water. Absolute commercial control of the slime-forming moulds, *Aspergillus niger*, *Penicillium puberulum*, *Chaetomium globosum*, and *Mucor racemosus* has been secured by the introduction into the system of dowicides A, B and C (sodium *o*-phenylphenate, sodium 2:4:5-trichlorophenate, and sodium 2-chloro-*o*-phenylphenate, respectively), as well as by F and G, at concentrations of 0.02, 0.03, 0.04, and 0.2 per cent., whilst B was also completely mycostatic at 0.004 to 0.009 and F at the last-named strength. The addition of dowicide G (2 per cent. by weight) to the starch adhesive used for the pasting of corrugated stock boards to the outer ply secures a mould-resistant surface. Either A or G may be applied to the inner wraps of soap, and the oil-soluble dowicide I (*o*-phenyl-phenol), dissolved in the wax used for coating the outer wraps, exerts a fungistatic and fungicidal action on mould growth below the wax film.

The same preparation protects gummed tape from spoilage by moulds. Dowicide G protects insulation board and building papers from termites and fungal decay, for which purpose a concentration of 0.6 to 0.75 per cent. of the dry weight of the board should be retained. C.

**Tantalum Rayon Spinneret Cups and Jets.** C. C. Downie. *Silk & Rayon*, 1943, 17, 696-698. A general account of the use and advantages of sheet tantalum (Ta 99.95 per cent.) for the fabrication of spinneret cups and jets. They can be cleaned by steeping in hot aqua regia. C.

**"Celairese" Acetate Rayon Staple: Application in Quilted Garments.** *Rayon Textile Monthly*, 1943, 24, 478. "Celairese" is an acetate staple fibre material produced in white and black for the interlining of quilted garments and bed coverings. Its resistances to rotting, insects and perspiration are claimed as advantages. C.

**Nylon Materials: Application.** *Rayon Textile Monthly*, 1943, 24, 457-8. A brief "Progress Review on New Uses for Nylon" includes the following items: (1) Rope for picking up air mail by aircraft in flight, (2) glider towing rope, (3) tyre yarn, (4) bristles for gun and shell cleaning brushes, (5) tapered bristles for paint brushes, (6) diaphragms, impregnated with Neoprene, for aeroplane engine carburettors, (7) shoe laces, highly resistant to rotting, (8) tentage, and (9) blood plasma filters. C.

**Wood Pulp: Production.** D. B. Halpern. "Times" *Trade & Engineering*, 1943, 54, Nov., p. 9; Dec., p. 5, 23. Some particulars are given of the magnitude of the different firms producing pulp for rayon in Canada, the United States, Sweden and Central Europe, with statistics of output. C.

**Cuprammonium Cellulose Solutions: Preparation.** M. A. Glatman. *Tekh. Byull. GUV*, 1940, No. 3, 25-30 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 127 and *Chem. Abstr.*, 1943, 37, 5588<sup>3</sup>). The author investigated the spinning solutions of cellulose prepared with crystalline cupric hydroxide and used for spinning by the alkali method. The optimum conditions for the solution are: ratio Cu: cellulose = 1.35-1.40 and temperature 15°. The content of ammonia in the spinning solutions is 0.7 g. per g. of cellulose. The technical process for obtaining cuprammonium solutions of cellulose, conditions of their filtration and evacuation are described. C.

**Cuprammonium Rayon Steeping Lye: Repeated Use.** A. B. Pakshver. *Tekh. Byull. GUV*, 1940, No. 3, 21-24 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 127 and *Chem. Abstr.*, 1943, 37, 5588<sup>4</sup>). Steeping lye can be used repeatedly for the steeping of linters for the production of cuprammonium rayon. This decreases the expenditure of caustic soda by 55 per cent. and of steam by 28 per cent. C.

**Cuprammonium Spinning Solutions: Regeneration.** A. B. Pakshver. *Tekh. Byull. GUV*, 1940, No. 2, 44-45 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 128 and *Chem. Abstr.*, 1943, 37, 5588<sup>5</sup>). The regeneration method is based on the decomposition of the complex copper compounds and on the precipitation of copper oxide at higher temperatures after distillation of a part of the ammonia. The spinning solution is returned to production after boiling and removing the greater part of the ammonia, and copper oxide is separated on a filter press as a dense precipitate. This precipitate is ignited, dissolved in an acid-finishing solution and transformed into the basic copper salt. C.

**Cellulose: Acetylation.** M. S. Sverdlin and A. V. Maiforova. *Tekh. Byull. GUV*, 1940, No. 3, 31-33 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 127 and *Chem. Abstr.*, 1943, 37, 5587<sup>6</sup>). To study the acetylation process of cellulose under heterogeneous conditions for obtaining a product of any degree of esterification, the authors developed a method for determining the content of acetic anhydride in the acetylating bath. The content of acetic anhydride is determined from the amount of aniline used for the titration of a definite amount of the acetylating mixture; the end point is indicated by the red colour produced by excess aniline in the solution on filter paper moistened with furfural. C.

**Cellulose Esters: Production and Properties.** N. I. Nikitin. *Uchenye Zapiski Leningrad. Gosudarst. Univ., Ser. Khim. Nauk*, 1940, No. 5 [No. 54], 79-87 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 126 and *Chem. Abstr.*, 1943, 37, 5587<sup>7</sup>). Some important questions for the understanding of

heterogeneous processes in the formation of cellulose esters are discussed. Small amounts of acetic anhydride and an excess of alkyl halide were added to the alkylation reaction. Cellulose was mercerised in caustic soda solutions in the presence of sodium zincate in the expectation that this addition would result in a considerable swelling of cellulose, facilitating its subsequent esterification. The addition of acetic acid increased the total degree of esterification and facilitated the production of more soluble products. Addition of sodium zincate had no important effect on the degree of esterification of cellulose. Methods for the production of benzylcellulose from alkylcellulose and from basic copper cellulose were compared. Comparatively little esterified products were obtained from basic copper cellulose as the initial product. However, the solubility of these products was sufficiently high for practical purposes. C.

**Cellulose Xanthate: Grinding and Solution.** A. B. Chachkhiani. *Tekhl. Byull. GUIV*, 1940, No. 12, 13-23 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 128 and *Chem. Abstr.*, 1943, 37, 5587<sup>3</sup>). The time of solution can be reduced from 5-6 hours to 3 hours by grinding the xanthate and by introducing a number of changes into the construction of the apparatus used for dissolving cellulose xanthate. C.

**Viscose: Filtration.** A. Marschall. *Beiheft Z. Ver. deut. Chem.*, No. 45; *Die Chemie*, 1942, 55, 49 (through *Chem. Abstr.*, 1943, 37, 5587<sup>1</sup>). By determination of the filtration value, the influence of the following factors on the filtration of viscose was investigated: kind of pulp, temperature and concentration of the steeping liquor, the state of division of the alkali-cellulose, the hemicelluloses in the steeping liquor and in the dissolving liquor, the manner of solution of the xanthate, the amount of carbon disulphide used in sulphiding, and the composition of the viscose. Incompletely dissolved cellulose particles are the principal cause of poor filtration. A clear-cut relation of the ash of the pulp to its filtration value could not be established. C.

**Viscose Rayon: Bleaching and Desulphurizing.** L. A. Malafeev, L. A. Gorodetskaya and Y. V. Gagarinskii. *Tekhl. Byull. GUIV*, 1940, No. 3, 59-62 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 127 and *Chem. Abstr.*, 1943, 37, 5862<sup>1</sup>). Addition of 1 g. of sodium silicate per litre decreased the required concentration of alkali in the desulphurizing bath from 10 to 6 g. per l. and that of active chlorine from 1.3 to 0.5 g. per l. Stretching of the fibre in the wet state is improved by addition of water glass to the bleaching bath. A method for determining silica in the hypochlorite bleaching bath is described. C.

#### PATENTS

**Rayon Staplising Apparatus.** British Celanese Ltd. B.P.556,617 of 10/4/1942: 13/10/1943 (Conv. 11/4/1941). Apparatus for the production of staplised yarns comprises a member carrying an abrasive member and adapted to be rotated by contact with a running yarn, and a guiding edge, curved about a centre on the axis of the rotatable member, adapted to deflect and guide the yarn between the rotatable member and the abrasive member. The guiding edge may be an annular edge coaxial with and rotating with the rotatable member. This may be a freely rotatable pulley, and the abrasive member may be a disc of larger diameter. The apparatus may be in the form of a self-contained staplising device for attachment to a winding or twisting and winding machine. C.

**Cellulose Acetate Liquid Treatment Apparatus.** British Celanese Ltd. B.P. 556,942 of 23/4/1942: 28/10/1943 (Conv. 24/4/1941). An apparatus for treating solid materials in particle form with liquids comprises a vessel having partitions dividing it into a series of compartments, means for feeding the solid materials at one end of the series and the liquid at the other end of the series, each partition having an opening spaced from the bottom of the vessel, and constituting an outlet opening for one compartment and an inlet opening for the next for the passage of solid materials and a further opening for the passage of liquid in the opposite direction, a lifter member for the solid materials and a lifter member for the liquid in each compartment, the former to lift solid materials at intervals to the level of the outlet opening of its compartment and discharge the solid materials through the outlet opening into the next compartment, and the latter to lift the liquid at intervals so that the liquid runs through the further opening into the preceding compartment, and means for actuating the lifter members. The apparatus may conveniently be arranged so that the vessel

rotates about an axis extending through each of its compartments, the lifter members being fixed in each compartment and actuated by the rotation of the vessel. The lifter member for the solid materials may be in the form of a perforated sheet. C.

**Interpolyamide Filaments: Production.** E. I. Du Pont de Nemours & Co. B.P. 556,946 of 24/4/1942:28/10/1943 (Conv. 18/4/1941). A process for the production of fibre-forming interpolyamides of high molecular weight having high softening points and good solubility and pliability, comprises polymerising a polyamide-forming composition, comprising a mixture of reactants consisting essentially of from 35 per cent. to 48 per cent. by weight of hexamethylenediamine and sebacic acid in substantially equimolecular proportions and from 65 per cent. to 52 per cent. by weight of tetramethylenediamine and adipic acid in substantially equimolecular proportions. Preferably, there is used a mixture of 35-48 per cent. of hexamethylenediammonium sebacate and 65-52 per cent. of tetramethylenediammonium adipate. C.

**Strong Cellulose Acetate and Regenerated Cellulose Yarns: Production.** H. Dreyfus. B.P. 557,004 of 20/3/1941:1/11/1943. Yarns and similar articles of high strength are produced by stretching products formed from acetone-soluble cellulose acetate of high viscosity, i.e. a viscosity of at least 40 as determined by comparing the rate of flow of a 6 per cent. solution of the acetate in acetone with that of glycerin taken as 100, obtained by ripening a primary cellulose acetate with an amount of water equal to at least 40 per cent. of the weight of the original cellulose. The best results are obtained by the use of an acetate having a viscosity between 60 and 120, particularly between 80 and 100. The tensile properties of the stretched articles may be further improved by completely saponifying them. By a proper choice of conditions it is possible to obtain cellulose acetate yarns having a dry tenacity of 5.5 to 6 g. per denier and regenerated cellulose yarns having a dry tenacity of 8 or 9 g. per denier and wet tenacities of up to 90 per cent. or more of the dry tenacities. C.

**Rayon Staplising Device.** Abbott Machine Co. U.S.P. 2,323,300. Continuous filaments, laid parallel to form a ribbon-like sliver, are advanced between drafting rollers against a cutting edge so that any filament under more than a predetermined tension is severed. The cutter is movable transversely of and along the sliver. The cut fibres are condensed into a staplised sliver. C.

**Rayon Tow Cutting Machine.** American Viscose Corporation. U.S.P. 2,323,644. The device illustrated intermittently severs a tow of continuous filaments and directs alternate cuts into separate discharge channels. C.

**Rayon Spinning Machine Driving Gear.** Industrial Rayon Corporation. U.S.P. 2,323,879. The claim is for a combination of main driving shaft, gear boxes, stub shafts and driven shafts for rotating thread-advancing, thread-store devices on a rayon spinning machine. C.

**Viscose Spinning Bath: Composition.** E. I. Du Pont de Nemours & Co. U.S.P. 2,324,437. Viscose containing 3.5-5 per cent. of caustic soda is spun into a sulphuric acid bath containing 8-18 per cent. of zinc sulphate, the percentage concentration ( $A$ ) of the sulphuric acid being within  $\pm 0.6$  per cent. of that given by the equation  $A = 0.75C - 0.1S + 3.8$ , where  $C$  is the percentage of alkali in the viscose and  $S$  the percentage of zinc sulphate by weight. C.

**Aluminium Hydroxide: Application in Cellulose Acetate Spinning.** C. Dreyfus and G. Schneider. U.S.P. 2,324,567. To prevent clogging of the spinning jets in the evaporative spinning of cellulose acetate filaments, finely divided aluminium hydroxide is added to the acetone solution. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Rayon Staple Drying, Lap-forming and Carding Machines.** J. W. Reinhardt (for Proctor & Schwartz, Inc.). *Rayon Textile Monthly*, 1943, 24, 470-472. Brief illustrated descriptions are given of the following new machines. (1) *Proctor Impact Dryer*, for drying acetate rayon staple. Heated air is impinged intermittently at high velocity on the cut staple as it travels on a conveyor formed of a band of perforated metal plates hinged together. The output of the machine is up to 2000 lb. per hour. (2) *Proctor Pin Cylinder Lap Unit*. This machine prepares thin webs from the loose staple and builds up 15 or 20



of them into a lap for the carding engine proper. One machine can feed several cards. Blending can be done efficiently at this stage by building up the card lap from appropriate weights of mixed webs or by feeding the machine continuously from the different supplies of fibre. (3) *Proctor Staple Fibre Card*. This special card has metallic wiring and its output is 50-100 per cent. more than with conventional card clothing. C.

**Worsted Drawing Frame Production.** D. Anthony. *Canadian Text. J.*, 1943, 60, No. 19, 33, 35, 44. Technical aspects of drawing frame speeds, drafts, weight of sliver, lay-out of machinery and efficiency of personnel are discussed with the object of expanding production while maintaining standards of quality. A table is given as a guide to production. W.

**Worsted Carding Cylinders.** W. H. Robinson. *Text. Rec.*, 1943, 60, No. 726, 38-39. Relative speeds, type and condition of card clothing, and card settings are discussed. W.

#### (B)—SPINNING AND DOUBLING

**Cotton Mill Stores: War-time Supply in India.** B. H. Kantawala. *Indian Textile J.*, 1943, 53, 360-362. The writer makes a number of suggestions for meeting the shortage of mill stores in India. (1) *Roller clearer cloths*. Flannel may be replaced by an 18-oz. cotton canvas or a softer canvas with 2's to 4's weft. (2) *Glue for roller cots*. Isinglass and acetic acid may be substituted by a preparation of glue (1 oz.), starch (2 oz.), turpentine (1 drachm) and water (q.s.). (3) *Rope grease*. Two recipes are given; the ingredients are castor oil, tallow, graphite, beeswax and molasses or soap. (4) *Size roller cover*. A cotton canvas woven 2/2 twill with double or single weft is recommended. Hessian has been used but it does not last long and tints the size. (5) *Picker sticks*. Dhaman wood, used for carriage poles, is a good substitute for hickory. (6) *Khaki dyeing*. A recipe for mineral khaki includes jaggery (a sugar concentrate of unfermented toddy). A decoction of the flowers of *Butea frondosa*, with iron sulphate, may be used for khaki dyeing with dichromate. (7) *Sulphur dyeing*. Sodium sulphide may be replaced in many recipes by crude molasses that is very largely thrown away in India. (8) *Waterproofing*. Recipes are given in which the main agents are castor oil and resins or gums. C.

**Worsted Yarn: Elimination of Slubs.** *Wool Rec.*, 1943, 64, 330, 332. Re-combing only partially eliminates slubs; the fitting of slub-catchers increases the cost of winding, and may lead to lack of care in processing. A slub-free raw material may develop slubs in the handling of the tops, by failure to keep the fallers clean, by careless piecings at the gill box, by not removing all twist from slubbing prior to feeding it to the gill box, and in creeling. The presence is discussed of bunches of dirty and discoloured fibres, of poor spinning piecings and of bad roller yarn. "Fly" is partially kept down by humidification and by the addition of a suitable wool cream at the first gill box in the drawing, but some type of vacuum cleaning device could usefully be incorporated into the design of each machine. W.

**Worsted Spinning Frame Stop Motions.** S. Smith. *Text. Mfr.*, 1943, 69, 419, 440. The advantages are stated of using full-bobbin stop motions in worsted spinning. Types of stop motion are described, and the calculations for their working explained. W.

#### PATENTS

**Buoyant Rope: Production.** Fine Cotton Spinners' and Doublers' Association. Ltd., C. Robins, Bleachers' Association Ltd. and W. Kershaw. B.P.556,747 of 16/4/1942:20/10/1943. A flexible rope which is capable of floating on fresh or salt water is made by treating fibres with an aqueous emulsion of a wax or fat or both and forming a rope having a specific gravity less than 1 from the so treated fibres. A flexible floatable rope may also be made by treating a coreless, loosely braided rope with an aqueous emulsion of a wax or fat or both while maintaining the apparent specific gravity of the rope less than 1. The emulsion may contain a protein such as gelatin or alternatively or in addition may contain an aluminium salt. A mineral wax such as paraffin is preferably used. A rope thus treated so that the individual fibres are resistant to wetting by water and still retaining in its interstitial cavities sufficient air to give it a specific gravity less than 1, is capable of floating for a period of from 1 to 10 days depending on the fibres employed and the nature of the treatment and the tightness with which the rope is made. Fibres of cotton, flax, manilla,

hemp, sisal, viscose, etc., may be used. The ropes are suitable for use as life lines in conjunction with sea rescue apparatus and as landing ropes for sea-borne craft and for such purposes may have luminiscent materials applied to them. C.

**Wax Coated Glass Fibre Yarn.** Owens-Corning Fiberglas Corporation. U.S.P. 2,323,684. The claim is for a spun glass fibre yarn in which the fibres are bonded together by a coating of wax. C.

**Roving Frame Drafting Mechanism.** Saco-Lowell Shops. U.S.P. 2,323,882. The mechanism consists of three sets of drafting rollers (1) a front pair with the top one weighted, (2) a slower driven middle combination of a weighted top roller engaging two smaller, bottom rollers, and (3) a back pair. Means are provided for keeping the middle top roller (a) and that one of its bottom rollers (b) that comes towards the front roller pair spaced apart by a pre-determined minimum distance so as to produce a positive draft between the front and middle sets of rollers and at the same time a slip control of fibres between rollers (a) and (b). C.

**Twisting Frame Yarn Guide.** James Foster and J. F. Brum (Bristol, R.I.). U.S.P. 2,323,987. A yarn guide for attachment to a twisting frame comprises an elongated rectangular shell having longitudinal slots, top and bottom, for the yarn, extension parts for fixing to the frame, a rectangular guide block that can slide in the shell and has a central slot for straddling the yarn, and spring means in the shell to check movement of the block in one direction. C.

**Folded Yarn with Singles under Different Tensions: Production.** Celanese Corporation of America. U.S.P. 2,323,991. Yarns are taken from a source of supply under equal tensions but one is made to travel a greater distance than the other(s) to the twisting head. The speed of travel is governed by the yarn(s) that travel(s) the shorter distance and this yarn is (these yarns are) stretched so that the folded yarn has components of equal length but different tensions. C.

**Rotary Table Sliver Forming Machine.** L. A. Runtun. U.S.P. 2,324,539. The machine combines a stationary bed, a rotary table bearing inner and outer sets of pins and wound packages of continuous-filament strands, a stationary guard covering the pins for a substantial part of their rotary movement, means on the table for drawing off the strands during determinate periods of arcuate movement and feeding them inwardly over the guard so as to build up a fringed lap and impale it on the pins, means for severing the impaled lap so that it is freed from the outer pins, means for withdrawing the fringe impaled on the inner pins and forming it into a sliver, and means for lifting the lap impaled by the outer pins so that it can pass on to the guard during the further rotation of the table. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (B)—SIZING

**Amioca Starch: Properties.** C. G. Caldwell. *Paper Trade J.*, 1943, 117, TAPPI, 171-173; *Rayon Textile Monthly*, 1943, 24, 541. Amioca starch, obtained from "waxy maize," consists only of amylopectin. Modified products such as thin-boiling starches made by wet acid hydrolysis retain the fluidity and non-gelling character of the original starch. This is in strong contrast to potato and tapioca starches the acid conversion products of which tend to be unstable and to gel because of the presence of shortened amylose molecules. Ordinary corn starch begins to gelatinize at 64° C. and continues over a range of 30° or more, whereas Amioca starch starts to gelatinize sharply at 70° C. and continues over a range of only 8°. The viscosities of dilute Amioca starch pastes are greater than those of tapioca starch pastes at temperatures of 75-90° C. The possibility of using Amioca starch in textile, paper and other industries is suggested. It is pointed out, however, that the economic future of this product is uncertain. C.

**Rayon and Staple Fibre Yarns: Sizing.** K. Walter. *Zellwolle, Kunstseide, Seide*, 1942, 47, 272-281 (through *Chem. Abstr.*, 1943, 37, 5869<sup>9</sup>). The proper sizing on the basis of industrial tests is discussed and special machines suitable for this operation are described. The results of tests made in various textile plants are cited. • • C.

## (C)—WEAVING

**Cotton Weaving Shed: Management.** H. M. Broadley. *Textile Weekly*, 1943, 32, 642-4, 681-2. The writer describes a system of production control, with illustrations of the various instruction sheets. C.

**Jacquard Terry Towels: Production.** O. Pomfret. *Textile Manufacturer*, 1943, 69, 422-425. The author discusses methods of tying-up the harness for the production of jacquard terry towels, the production of lettered towels and towels with designs covering the whole width, card cutter's instructions and card saving arrangements, a single-lift terry jacquard having double inverted hooks and knives which are capable of moving on their pivots, and developments in the double-lift terry jacquard, particularly the arrangement known as the terry or twin machine. C.

**Rayon Looms: Development.** J. W. Hutchinson. *Silk & Rayon*, 1943, 17, 678-680. Brief notes are given about Crompton & Knowles looms for rayon, automatic weaving in Russia, and recent British looms for rayon, and the claim that "several of our Allies are already ahead of us in organization and machinery" is attributed to lack of enterprise on the part of manufacturers and labour restrictions. C.

**Rayon Shuttles: Selection.** R. Makepeace. *Rayon Textile Monthly*, 1943, 24, 484-486. Progress in the design of shuttles for weaving rayon, especially on automatic looms, is reviewed, in brief notes on the material of the shuttle, tensioning devices, shuttle tongues and tips, and so forth. The writer pleads for a reduction in the variety of shuttles to a few agreed types. The direction of wind of the pirn for S- and Z-twist yarns is also discussed, the writer preferring the "regular" wind for both twists since this makes for smoother transfer and threading on bobbin-changing looms. C.

**Stainless Steel Healds and Reeds: Application in Nylon Weaving.** *Rayon Textile Monthly*, 1943, 24, 483. It is claimed that stainless steel is essential for healds and reeds when weaving nylon parachute cloth and acetate rayon fabrics, for which a relative humidity of at least 75 per cent. is said to be necessary. Nickel-plated healds and ordinary steel reeds give rise to black rust stains. C.

**Silk Parachute Cloth: Manufacture in Mysore.** M. A. Qadir. *Indian Textile J.*, 1943, 53, 372. A brief outline is given of the weaving of silk parachute cloth in Mysore, with particular reference to the development of "fluff" and other defects. C.

**Cotton Mill Stores: War Time Supply in India.** See Section 2B.

## (G)—FABRICS

**Aviator's "Precision" Gloves: Advantages of Rayon.** American Viscose Corporation. *Rayon Textile Monthly*, 1943, 24, 479. A brief note on the advantages of rayon for gloves for protection against freezing when handling instruments and maps at high altitudes. An airman who had lost his heavy outer gloves made a successful parachute landing from 40,200 ft. C.

**Cotton and Rayon Lens Polishing Cloth.** Bausch & Lomb Optical Co. *Rayon Textile Monthly*, 1943, 24, 482. A cloth with cotton yarn one way and rayon the other is preferred for polishing lenses. An all-cotton fabric casts too much lint and an all-rayon fabric is not sufficiently absorbent. C.

**Noiseless Fabrics: Production.** A. G. Arend. *Textile Recorder*, 1943, 61, September, 42, 44. A brief review of the design and finishing of fabrics that shall be noiseless in film studios. Suggestions are also made for detecting sounds emitted by fabrics. C.

**Rayon Check Fabrics: Design.** J. W. Hutchinson. *Silk & Rayon*, 1943, 17, 628-630. Illustrations and warping and wefting particulars are given of (1) a viscose and acetate ratine fabric, (2) a bold check in yarn-dyed spun rayon, (3) an overcheck in yarn-dyed spun rayon, (4) and (5) checks with viscose and Seraceta yarns, (6) and (7) checks with various combinations of yarn-dyed acetate rayon. C.

## PATENTS

**Shuttle.** Jowett Brothers Ltd. and H. Jowett. B.P.556,674 of 20/5/1942: 15/10/1943. In a shuttle of the kind in which the spindle is pivotally held in position by means of a pin, the ends of the V-shaped block or rest supporting

the spindle are inserted in lateral recesses formed within the shuttle and held in place by means of a transverse pin or its equivalent passing immediately in front of the block or rest and engaging the latter throughout the whole length of the block or rest. The recesses may be formed by cutting out the side walls of the shuttle in such a manner that the V-shaped spindle supporting block or rest lies upon the base of the shuttle and is held at its ends in the recesses or grooves so formed. A steel pin driven through the side walls of the shuttle immediately in front of the block or rest retains the latter in its grooves or recesses, with the effect that it is rigidly secured on all its sides so that when the spindle is in its weaving position all further movement downward or sideways is prevented. C.

**Shuttle Pin or Tube Holder.** F. Crossley. B.P.556,699 of 6/6/1942:18/10/1943. A retaining fitment for pins or tubes having thin flanges comprises an approximate half ring or annulus which lies transversely across the shuttle with the open end uppermost having two parallel projecting legs one at each side of the open end adapted to be driven into the head of the shuttle peg or tong, the half ring or annulus being at a sufficient distance from the head of the shuttle to allow of the insertion of the flange between it and the head and its lower portion being sufficiently below the central axis of the peg or tong to permit the latter with the pin or tube upon it to be turned down into the operative position in the shuttle so that the flange on the ferrule will lie between the head of the shuttle and the fitment. When it is desired that the same shuttle should be employed for holding either thin flanged pins or tubes or broad flanged bobbins a substantially similar fitment is arranged in front of the fitment for holding the thin flanged pin or tube and a distance therefrom to accommodate the wider flange between the two fitments. C.

**Small-ware Loom Shuttle.** I. S. Cawthorn. B.P.556,792 of 20/6/1942: 21/10/1943. A shuttle of the type described in B.P.393,166 is characterised in that its bobbin pin is hinged at one end in one of the side members of the shuttle and is located at the other end in an undercut slot in the other side member of the shuttle, spring means being incorporated tending to press the bobbin pin into the undercut part of the slot and so prevent its dislodgement, the spring means serving also to move the pin outwards in readiness for changing the bobbin as soon as the pin has been released from the slot. C.

**Yarn Dressing Machine Reed.** E. Jennings. B.P.557,032 of 13/11/1942: 2/11/1943. In a yarn dressing, warping or like reed which comprises spaced tubular casings, a bank of splits or reed extending therebetween and held in end ribs or the equivalent located in the casings, and end plates at each end of the ribs and extending between and attached to the casings, the ribs and end plates are attached by wire or equivalent means located in grooves in the ribs and secured therein by the binding for connecting the ribs and spacing the splits or dents, the wire or equivalent means being secured to the end plates, as for example, by passing through holes therein and having the ends soldered or otherwise secured together. The join(s) in the wire is (are) additionally secured by being embedded in the lead filling in the ends of the casing. C.

**Run-resisting Knitted Fabric: Production.** C. A. Kaufman (New York). B.P.557,048 of 30/7/1942:2/11/1943. A run-resisting knitted fabric comprises basic yarn interlooped in plain knit courses of regular undistorted needle and sinker loops, and additional binder yarn extending substantially from edge to edge of the fabric in selected pairs or in every pair of adjoining courses of the basic yarn. Both legs of every needle loop and sinker loop are engaged in regularly repeated sequence by the binder yarn which is looped around both legs of a needle loop in one course of each pair of courses and around both legs of an adjacent sinker loop in the other course of each pair of courses. The method of producing the fabric comprises laying a course of basic yarn loops upon adjoining needles of a bank of needles, forming a series of binder yarn loops upon the same needles, drawing one of the binder yarn loops through each one of the basic yarn loops without casting off the latter, transferring each of the basic yarn loops to the next adjoining needle while retaining the binder yarn loops upon the needles, knitting another course of basic yarn loops into the previously-formed basic yarn and binder yarn loops, again forming a series of binder yarn loops, and continuing the described cycle of procedure. C.

**Weft Cop Winding Machine.** Linen Industry Research Association, C. C. Bodel and L. A. R. Waring. B.P.557,113 of 10/6/1942:4/11/1943. In a machine for winding weft yarn into cops on a bare spindle either with or without a small cone of paper on which to start the cop, the cap for the top of the spindle fits on to a smooth cylindrical end of the latter and is retained in position by one or more spring-loaded levers, each of which engages directly or through the intermediary of a dog with a corresponding hole or recess in the spindle. A doffing lever is provided for moving the spindle downwards through the stationary, full cop after the spindle cap has been removed for the purpose of doffing. C.

**Yarn Winding Machine.** Clark Thread Co. (Newark, New Jersey, U.S.A.). B.P.557,119 of 30/6/1942:4/11/1943 (Conv. 23/10/1941). A winding machine of the type wherein traverse mechanism carrying a thread guide moves axially and radially in relation to a bobbin mounted to rotate with and move axially along a horizontal revolvably-mounted arbor, comprises bobbin-urging means mounted to swing in a horizontal plane and tending to urge the bobbin axially along the arbor; a cam mounted to rotate about an axis parallel to the axis of the bobbin, the cam having a periphery which, in projection, from its operative position, on a horizontal plane, has a contour of substantially the same character as the contour of the taper of the end of the thread or like mass to be wound on the bobbin, the cam periphery engaging the bobbin-urging means and opposing the axial movement of the bobbin; and means actuated by the radial movement of the traverse mechanism to rotate the cam and thereby permit the bobbin-urging means to follow the cam periphery and to impart axial movement to the bobbin in accordance with the character of the periphery. C.

**Yarn Winding Machine.** Clark Thread Co. (Newark, New Jersey, U.S.A.). B.P.557,146 of 30/6/1942:5/11/1943 (Conv. 8/11/1941). A device adapted for use on a winding machine for thread and the like of the type wherein a traverse frame carrying a thread guide moves radially in relation to a bobbin mounted for coaxial rotation with and longitudinal axial movement in relation to a revolvably mounted mandrel, comprises a hollow conical member having an axis coinciding with the axis of the mandrel and mounted to rotate with and move axially along the mandrel and being adapted to impart the axial movement to the bobbin, and means, slidably engaging the internal and external surfaces of the conical member, mounted on the traverse frame for movement with the frame radially in relation to the axis of the bobbin, to move the conical member and bobbin axially simultaneously with the radial movement. The means for moving the conical member and bobbin axially comprises a yoke secured to the traverse frame and having legs which straddle the edges of the conical member. C.

**Elastic Knitted Selvedged Fabric: Structure.** Hemphill Co. U.S.P.2,323,855. A knitted selvedged fabric has in the interspersed wales adjacent to the selvedge alternating loops of elastic and non-elastic yarns, the intervening wales comprising four accumulated loops, starting with a loop of inelastic yarn. C.

**Elastic Selvedged Fabric: Knitting.** Hemphill Co. U.S.P.2,323,988. Elastic yarn is fed in the initial course to form a selvedge and thereafter inlaid at spaced wales in each course, and inelastic yarn is drawn into independent stitches at alternate wales in consecutive courses but held and tucked at intermediate wales, whereby alternate strands of elastic are inlaid and held at intermediate wales while intermediate strands of elastic are threaded between tuck loops in intermediate wales and plain loops at alternate wales. C.

**Knitting Machine Horizontal Striping Mechanism.** Hemphill Co. U.S.P. 2,323,998. A drum with cams, governed by a single pattern control, is used for changing yarns during horizontal striping. C.

**Elastic Selvedged Stocking Top.** Hemphill Co. U.S.P.2,324,035. A selvedge is knitted at the beginning edge of a circular, seamless stocking top by drawing a number of courses of elastic yarn so that at each course a loop of elastic yarn is temporarily formed at what are to be alternate needle wales in the top, then drawing a course of non-elastic yarn by forming needle loops at each wale with sinker loops between them, and drawing the course of non-elastic yarn while simultaneously casting off the courses of elastic yarn so that they will be held by the course of non-elastic yarn in such a manner that each of them is threaded

through all the sinker loops of the initial course, each strand lying parallel to the next and all being threaded through the sinker loops in the same direction. C.

**Elastic Stocking Top.** Hemphill Co. U.S.P.2,324,036. Elastic yarn is fed under tension and held at spaced wales to draw them together and inelastic yarn is tucked at intermediate wales so as to create a barrier resistant to the curling or rolling of the stocking top. C.

**Loom Reed Threading Device.** Victor Lobl and E. L. McCormick (Spindale, N.C.). U.S.P.2,324,220. A reed hook is combined with a feeding device including a reed selector blade (a) and a back blade (b) that can spring together into interlocking engagement with the main blade (c) of the reed hook. On downward movement of the device, a selected reed passes upwardly between blades (a) and (c) and then on upward movement of the device the reed passes between blades (c) and (b). C.

**Fully-fashioned Stocking Heel Tabs: Knitting.** Real Silk Hosiery Mills, Inc. U.S.P.2,324,256. The claim is for a method of knitting the heel tabs of a stocking blank so that the rows of fashion marks produced by narrowing are flanked by wales that extend continuously, without fashion marks, through the heel tabs into the foot portion. C.

**Rotary Knitting Machine Electric Ring.** Michael Wachsmann (Brooklyn, N.Y.). U.S.P.2,324,442. Two electrically conducting rings that rotate one on the other in contact are totally enclosed (to prevent entrance of dirt) by a pair of annular, insulating rings in interlocked, sealed relationship. C.

**Axminster Loom Lint-removing Nose Board.** Crompton & Knowles Loom Works. U.S.P.2,324,564. An Axminster loom with spaced reed dents that operate in alignment with spaced guide plates is also provided with a cloth-supporting nose board having teeth spaced by slots in which lint tends to collect during weaving. The slots are located so as to receive the guide plates as these reciprocate, and are shaped so that the lint is readily cleared by the guide plates. C.

**Weft-replenishing Loom Bobbin Magazine.** Gosnold Mills Corporation. U.S.P.2,324,565. The claim is for a bobbin supply for a weft-replenishing loom that operates with two shuttles, one of which is depleted at a slow rate and the other at a fast rate though holding more than enough weft for any one period of its activity. The magazine has different stacks of reserve weft and appropriate stack selecting mechanism. C.

**Yarn Beam: Winding.** E. I. Du Pont de Nemours & Co. U.S.P.2,324,584. In the winding of a beam, a single yarn is wound with a traverse from end to end of the beam between the layers of the main supply. On unwinding the beam the single yarn is readily withdrawn and prevents entanglement of the filaments. C.

**Polyvinyl Alcohol—Boric Acid Sizing Composition.** E. I. Du Pont de Nemours & Co. U.S.P.2,324,601. A yarn sizing composition consists of an aqueous solution of a "hydroxylated polyvinyl resin" and 5-25 per cent. of boric acid, on the weight of the resin. C.

**Constant-speed Warping or Beaming Machine.** Fritz Lambach (Fairview, N.J.). U.S.P.2,324,611. An electrical control device, responsive to the building up of a yarn beam, is used to regulate the current input to the driving motor of a warping or beaming machine so that the yarn is wound under constant travelling speed. C.

**Warping or Beaming Machine.** Fritz Lambach. U.S.P.2,324,612. The beam flanges have centre holes, one of which engages with a driving head and the other with an idling head journalled in a bracket that can be moved into an inoperative position to permit free access to the flange of the beam. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (D)—MILLING

*Rec.*, 1943, 64, 681-682. The method formerly used by the author for milling all-worsted khaki 22½ oz. serge (see these *Abs.*, 1942, A179) has been modified. Two pieces of the serge were milled at the Wool Industries Research Association on a small size Williams-Peace combined milling and scouring machine, using a lighter weight on the top roller than was used in the mill. Large scale experiments were then made in the mill, with ¼ pieces in the machine run

in parallel, using 1,200 lb. on the top roller for milling, and reducing the width of the mouthpiece from 10 in. to 7 in. for scouring and from  $3\frac{1}{2}$  in. to 3 in. for milling. The milling time per piece was 1 hr. Wringing was done with 4,000 lb. on the top roller, care being taken to reduce to a minimum the amount of moisture left in the piece before adding the soap solution, which was 4 gal. of 10 per cent. W.

(E)—DRYING AND CONDITIONING

**Radiant Heat Generators: Application.** Margaret R. Weiss. *Rayon Textile Monthly*, 1943, 24, 499-501. Illustrations are given of the use of "Carbomatic" surface-combustion gas radiants as heat sources (a) under a tentering frame and (b) in a festoon drying chamber. C.

**Yarns: Standard Moisture Content for Australia.** (1) *Text. J. Australia*, 1943, 18, 243; (2) *ibid.*, 282. (1) A difficulty in the setting up of yarn moisture standards is that the establishment of testing houses in all Australian capital cities is involved. The testing house in Sydney is now functioning successfully, and the Central Wool Committee intends to establish similar units in all main centres. The Committee also hopes eventually to establish official conditioning houses for determining standards of percentage moisture regain to suit normal Australian atmospheric conditions; scoured wool, carbonised wool, tops, noils, wastes, yarns and cloths could thereafter be dealt with locally or be exported on the certificates of the Australian conditioning houses. (2) On the request of the Hosiery and Knitgoods Manufacturers' Association of New South Wales, a preliminary conference, convened by the Standards Association of Australia, was held in Sydney, in April, 1943, to discuss the moisture content of knitting yarns. The Chairman accepted, as a recommendation of the conference, "that this conference considers that the matter of moisture content of woollen yarns is one of sufficient importance to warrant the preparation of a standard as a matter of urgency." W.

(G)—BLEACHING

**Bleaching Solutions: Analysis.** C. F. F. Anadón. *Ion*, 1941, 1, No. 5, 17-20 (through *Chem. Zentr.*, 1942, ii, 1376 and *Chem. Abstr.*, 1943, 37, 5334<sup>7</sup>). Active chlorine is determined by adding hydrogen peroxide, preferably to a neutral solution, and measuring the volume of oxygen evolved in the reaction  $\text{ClO}^- + \text{H}_2\text{O}_2 = \text{Cl}^- + \text{H}_2\text{O} + \text{O}_2$ . The determination can be carried out conveniently in a Riegler ureometer. The results agree with those obtained by the method of Pénot. The alkalinity and the  $\text{Cl}^-$  content can be determined by known methods. With hypobromite solutions the disappearance of the yellow colour can serve for determining the end point in titrations. Hydrogen peroxide solutions can be tested conveniently with freshly-prepared sodium hypochlorite solution. C.

(I)—DYEING

**Glass Fibre: Colouring.** H. Freytag. *Klepszig's Text. Z.*, 1942, 45, 49-51 (through *Chem. Zentr.*, 1942, i, 2931 and *Chem. Abs.*, 1943, 37, 3574). The use of the glass fibre as a textile raw material is discussed. The manufacture of coloured glass fibres by drawing out coloured glass is a difficult industrial operation, as the colour depth decreases with the fibre fineness. The capillary filling of hollow glass fibres with dyed monostyrene or paraffin was tried. Treatment of the glass fibres with lead acetate and ammonium sulphide or potassium dichromate weakens the fibre appreciably. The surface of the fibre can be treated so that it absorbs alkaline, substantive and acid dyes. The resistance to rubbing of these dyeings is still low. W.

**Mixed Textile Fibres: Dyeing.** R. Haynn. *Deut. Wollen-Gewerbe*, 1942, 74, 21-22; *Deut. Textilwirt.*, 1942, 9, 30 (through *Chem. Zentr.*, 1942, i, 2585 and *Chem. Abs.*, 1943, 37, 3609). To save chrome, wool can be dyed with Helindon dyes, staple rayon with Indanthren and sulphur dyes, and shoddy with combinations of wool vat dyes and Immedial Leuco dyes. Substantive dyes which are after-treated with formaldehyde, and dyes of the Nitrazol Black M and Union Fast Dark Brown B types yield fast dyeing without the use of chrome. Various mordant dyes can be used with substantially smaller amounts of chrome salts than are usually employed. In dyeing cotton naps, the cotton is treated hot while the wool is protected by the use of Katanol. The protein fibres Tiolan, lanital and Thiozell are dyed with chrome dyes at 60° and chromed at 80°; Palatine Fast dyes are used at 60-70° with acetic or formic acid. Some Immedial dyes can be used with hyposulphite and soda at 40-50°



without weakening the fibre. The casein fibres must be centrifuged thoroughly before drying. W.

**Dyeing Machinery: Influence on Dye Penetration.** *Silk & Rayon*, 1943, 17, 686-688. The writer discusses the extent of dye penetration commonly experienced in (1) dyeing with the fabric in rope form in a winch machine, (2) jig dyeing in open width, (3) padding in open width in a mangle type of machine, and (4) dyeing by pumping the liquor through the stationary fabric in a perforated container. C.

**Sequoia Redwood Fibre: Dyeing.** H. Luttringhaus. *Rayon Textile Monthly*, 1943, 24, 489-490. Sequoia bark fibre is being used in blends with wool. It is described as matching a 2 per cent. dyeing of Amido Naphtol Brown 3CA, but capable of bleaching, with peroxide, to the shade of a manila envelope. A list of suitable dyes is given, for dyeing before blending or for use on blends with wool. Browns and navy blues are the best ranges. C.

**Wurster Dye Free Radicals: Polymerization.** See Section 9.

**Bismuth Mordant: Application.** H. Truttwin. *Klepszig's Textil-Z.*, 1942, 45, 309 (through *Chem. Zentr.*, 1942, ii, 1629 and *Chem. Abstr.*, 1943, 37, 5869<sup>n</sup>). A mordant from bismuth tri-iodide and potassium iodide on wool produces a fast yellow in the cold and a bright orange when hot. A typical mordant bath consists of 2 parts bismuth tri-iodide, 50 parts potassium iodide and 3 parts glycollic acid in 100 c.c. of water; this solution may be diluted. This bismuth mordant turns alizarin dark reddish brown,  $\alpha$ -aminoalizarin violet, and  $\beta$ -aminoalizarin brown. The mordant may be used also as an after-treatment. The reaction between wool and this bismuth double salt may possibly be used also in the analysis of textile fibres. C.

**Direct Dyeings: After-treatment.** O. Sharma. *Indian Textile J.*, 1943, 53, 357-358. Recipes are given for the after-treatment of direct dyeings with (1) copper sulphate, (2) dichromate, (3) copper sulphate + dichromate in one bath, (4) dichromate + chrome alum + chromium fluoride, (5) bleaching powder, (6) formaldehyde, and (7) by diazotisation and coupling. In each case, the effect on the fastness of the dyeing is briefly stated. C.

**Indocarbon Black: Application.** W. Meerkötter. *Klepszig's Textil-Z.*, 1942, 45, 400-405 (through *Chem. Zentr.*, 1942, ii, 1181 and *Chem. Abstr.*, 1943, 37, 5593<sup>n</sup>). The author deals with black dyeings by means of indanthrene, naphthol, Indocarbon and Sulphur Black, and fibre weakening by Sulphur Black and its complete removal by after-treatment in the final bath with sodium acetate or soda. The Indocarbons do not cause fibre weakening during storage and the fastness of the dyeing is good. Indocarbon has poor resistance to rubbing and poor rinsing properties. Prolonged contact with the dyeing bath, making a paste from the dye and Nekal, and the addition of Dekol, Trilon B and similar products to the bath eliminate this fault. Proper rinsing immediately after the dyeing is also important. The oxidation is best carried out with perborate. C.

**Retarding Agents: Use in Vat Dyeing.** A. Birrotteau. *Teintex*, 1942, 7, 139-142 (through *Chem. Zentr.*, 1942, ii, 1181 and *Chem. Abstr.*, 1943, 37, 5594<sup>n</sup>). Suitable synthetic products for replacing glue and gelatin are Dekol, Unisol N extra, Cellex, and thickened sulphite waste liquor (30° Bé). These products are resistant to lime, are good protective colloids, disperse well and stabilize the baths, but their retarding effect is low. With some dyes a good levelling action is caused by the use of the sulphite liquor derivative, but not with Peregal O and Albatex P.O. Peregal O is an excellent wetting and retarding agent; Peregal OK should be used with Indanthrene Blue. Albatex P.O. exhibits similar properties. C.

**Spun Rayon Piece Goods: Dyeing.** L. Bonnet. *Teintex*, 1942, 7, 109 (through *Chem. Zentr.*, 1942, ii, 1404 and *Chem. Abstr.*, 1943, 37, 5595<sup>n</sup>). Rayon staple has high water absorption, swelling power and alkali sensitivity. Dyeing is carried out preferably at pH 3.5-8. If direct dyes are to be used at pH 6, some formic acid should be added. The temperature should be as low as possible. Mechanical stresses should be minimized as much as possible, particularly as long as the goods are wet. Dyeing machines which operate under reduced pressure offer many advantages. For mercerisation the goods are placed dry into a mixture of 30° Bé. caustic soda and caustic potash, preferably cold, are squeezed to remove excess liquid and are then rinsed hot. C.



**Vegetable Fibres: Dyeing.** E. Weskott. *Kleppzig's Textil-Z.*, 1942, 45, 589-594 (through *Chem. Zentr.*, 1942, ii, 1629 and *Chem. Abstr.*, 1943, 37, 5869<sup>a</sup>). A discussion of dyeing with indanthrene, anthrasol, naphthol and indanthrene dyes, the prevention of excessively rapid absorption of dyes, the properties and uses of anthrasols, esters of vat leuco dyes and important naphthol-AS combinations. Hints are given on working with naphthol AS dyes, and the development and uses of Diazopon A or Setamol WS are described. C.

**Cotton Mill Stores: War Time Supply in India.** See Section 2B.

**Chromophores: Mutual Influence. Triphenylmethane Dyes: Absorption Spectra, and Constitution.** See Section 9.

#### (J)—PRINTING

**Print Ager; Rise of Temperature in —.** A. B. Meggy. *J. Soc. Dyers & Col.*, 1943, 59, 192-196. In the ager, the print absorbs water, and the cloth is dyed from the solution formed on the fabric. This solution contains the solutes originally present in the printing paste which, with vat dye printing pastes, usually comprise carbonate, Na sulphonylate-formaldehyde, glycerol, and a thickener such as British gum. If the solution is to be in equilibrium with the steam it must be at its boiling point. In an attempt to explain observed rises in temperature, often up to 110° C., in the ager, determinations were made of the boiling points of solutions of various mixtures of the printing paste ingredients. Preliminary experiments showed that British gum caused very little elevation of the boiling point of water, a 50 per cent. solution showing an elevation of only 0.5° C. On the other hand, large elevations were observed for K carbonate, glycerol and Na sulphonylate-formaldehyde. Tables and graphs are given showing the boiling points of solutions of mixtures of two and three of these ingredients in different proportions and concentrations. It is pointed out that the boiling point elevation effect caused by the crystalloidal components of the printing paste is sufficient to account for the rise in temperature in the ager during the steaming of vat dye prints. C.

**Vat Dye Prints: Reduction Potentials During Steaming.** A. B. Meggy and J. Rogers. *J. Soc. Dyers & Col.*, 1943, 59, 215-217. The reduction potentials of vat dye prints during ageing have been measured by means of a platinum wire as electrode, with a bridge of saturated potassium chloride to an external calomel half-cell. Details of the apparatus and procedure are given. Reduction potentials, referred to the normal hydrogen electrode, are tabulated for prints obtained with pastes containing potassium carbonate (14 per cent.), sodium sulphonylate-formaldehyde (4.16 per cent.), and British gum (82.70 per cent.). Readings were taken every 0.5 min. during steaming, over a period of 5 min. The potentials varied with the sodium sulphonylate-formaldehyde concentration from -630 to -670 mv. In the absence of sodium sulphonylate-formaldehyde, the British gum alone showed a substantial reducing power, giving a potential of -550 mv. The significance of these results is discussed and it is pointed out that for printing to take place under the most favourable conditions, the reduction potential on the print should be more negative than the critical reduction potential of the dye. C.

**White Discharged Viscose Rayon: Tendering by Perborate Washing Agents.** See Section 7. C.

#### (K)—FINISHING

**Sulphonated Oil Products: Properties and Uses in Textile Processing.** "Technicus." *Text. Col.*, 1943, 65, 283-287, 330. The wide scope of the textile applications of sulphonated oils is indicated. Their manufacture, the mechanism of their action as surface-active agents, and their use as dispersing agents for vat dyes are described. Historical notes are given on some early uses of oil in printing and dyeing, the affinity of oil as a mordant, and Turkey Red dyeing. W.

**Casein Fibre Resistant to Hot Water.** G. A. Arbuzov and A. M. Kats. *J. Appl. Chem. U.S.S.R.*, 1942, 15, 354-361 (French summary) (through *Chem. Abs.*, 1943, 37, 4252). Chrome-tanned casein fibre is highly resistant to hot water, can be carbonised, can be dyed along with wool, and has a fibre strength 70 per cent. of that of wool. The spun fibre is left for 8-10 hr. at pH 4.5 in formalin solution containing sodium chloride or sodium sulphate, drained, washed with water and tanned with basic chromium salts for 1 hr. at 45°. W.

**Polyacrylic Acid Esters: Use in Finishing.** L. Bonnet. *Teintex*, 1942, 7, 145-146 (through *Chem. Zentr.*, 1942, ii, 1532 and *Chem. Abstr.*, 1943, 37, 5596<sup>7</sup>). Aqueous dispersions of these esters are used in textile finishing. In cloth printing, they can be used for the fixation of dyes or metallic powders. The esters are used also in baths for water-repelling treatments. Fabrics containing staple fibre and rayon coated with Plexigum are waterproof and resistant to benzine and oils. C.

**Fabrics: Finishing.** E. Calchi-Novati. *Boll. Cotoniera*, 1941, 36, 349-353, 397-403 (through *Chem. Zentr.*, 1942, ii, 1193 and *Chem. Abstr.*, 1943, 37, 5596<sup>7</sup>). A review of recent experiments on shearing, dyeing, printing and finishing. C.

**Laminated Plastic Impregnating Machines.** A. N. Levin and S. M. Arbitman. *Informatsionno-Tekhn. Byull. Glavkhimplasta*, 1940, No. 4-5, 42-63 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 124 and *Chem. Abstr.*, 1943, 37, 5512<sup>7</sup>). The machines are designed for impregnating fabrics of 400 g./sq. m. or of 150 g./sq. m., and for paper of 40 g./sq. m. The fabrics are saturated with such an amount of the resol emulsion resin that the amount of the resin after drying is 50 per cent. of the weight of the unimpregnated fabric. A number of mechanical improvements are introduced into the apparatus. C.

(L)—PROOFING

**"Utility" Gabardines: Finishing.** *Textile Manufacturer*, 1943, 69, 443-444, 447. Details are given of procedures for the preliminary treatment, dyeing, waterproofing and testing of utility gabardines. C.

**Moth-proofing Agents: Development.** C. O. Clark. *J. Soc. Dyers & Col.*, 1943, 59, 213-215. A brief history of commercial moth-proofing in the period 1920-1940, dealing particularly with the development of the various Eulan agents. C.

**Fluoride Moth-proofing Agents: Determination in Wool.** See Section 5C.

**Rubber: Ageing in Light; Resistance to Abrasion; Water Sorption.** See Section 5D. C.

**Organic Fillers for Rubber: Application.** T. R. Dawson, R. C. W. Moakes and R. G. Newton. *Trans. Inst. Rubber Ind.*, 1943, 18, 286-306. Various non-standard substitutes, fibrous fillers, and hydrocarbon "extenders" for rubber are reviewed, and a report is given of laboratory tests of rubber mixings containing "extenders" such as bitumens, rosins, blown linseed oils, mineral rubber, "Vibad" and various "Hibads." The ease of mixing, the plasticity and relative fluidity of the stock, the influence of magnesium compounds on Hibad materials, and the properties of the vulcanised materials are studied. The influence of Hibads on the properties of synthetic rubbers is discussed. C.

**Polish Stratosphere Balloon Fabric: Proofing.** S. Mazurek. *India-Rubber J.*, 1943, 105, 379-382. The author describes the method of proofing the fabric of a stratosphere balloon, constructed in Poland in 1939. Some 15,000 sq. m. of a very light but strong silk fabric were used. The fabric was first treated with a proofing mixture to fill the pores and to provide a smooth, tacky surface, and a thin gas-tight film was then applied to the tacky surface. The outer face of the fabric was then coated with colloidal aluminium. French chalk was applied and the fabric was vulcanised by hot air in a special chamber (one hour at 120° C.) by the continuous process. C.

**Mothproofing with *p*-Dichlorobenzene: Possible Danger.** M. Perrin. *Bull. acad. m d.*, 1941, 125, 302-304 (through *Chem. Zentr.*, 1942, i, 3232 and *Chem. Abs.*, 1943, 37, 3833). A 62 yr. old man wearing clothes impregnated with *p*-dichlorobenzene developed asthenia and attacks of vertigo. There was an mia with hypogranulocytosis. Normalisation of the blood picture was delayed for a long time. The picture was similar to that caused by benzene.

**Fluorine: Determination in Wool Treated with Fluorides.** F. F. Elsworth and J. Barritt. *Analyst*, 1943, 68, 298-301. A method is described for determining fluorine in wool mothproofed with fluorides. The sample is ashed, and the fluorine distilled from the ash as fluosilicic acid and estimated colorimetrically by its decolorising action on thorium-alizarin lake. Satisfactory recoveries of known amounts of fluorine added to wool have been obtained. The method is designed to determine up to 0.5 per cent. fluorine (on the weight of wool) with an accuracy of the order of 5 per cent. • • W.

**Commercial Mothproofing: History, 1920-1940.** C. O. Clark. *J. Soc. Dyers & Col.*, 1943, 59, 213-215. W.

## PATENTS

**Stilbene Dyes: Production.** J. R. Geigy A.-G. (Basle). B.P.556,580 of 27/11/1941:12/10/1943 (Conv. 28/11/1940). Stilbene dyes are made by alkaline condensation of dinitrostilbenedisulphonic acid or dinitrodibenzyl-disulphonic acid or conversion products of *p*-nitrotoluenesulphonic acid with aminodiaryltriazoles that contain at least one sulphonic acid group and/or carboxylic group but are free from azo groups. The aminodiaryltriazoles may be used alone or in admixture with other aromatic amino compounds which may contain azo groups and/or complex bound metal. The dyes obtained may be treated in substance or on the fibre with oxidising agents and/or, when metallisable groups are present with metal-yielding agents. The dyes dye cotton in yellow, orange, brown-red, brown, olive and other shades. These are distinguished from the dyeings produced with known stilbene dyes, in general by greatly improved water fastness, and in part by improved washing fastness, light fastness, dischargeability, and purer shades. C.

**Cellulose Ethers: Treatment to Improve Clarity.** J. H. Sharphouse, P. R. Hawtin, J. Downing and W. H. Groombridge (British Celanese Ltd.). B.P. 556,664 of 6/3/1942:15/10/1943. A process for improving the clarity of cellulose ethers comprises partially precipitating the ether from solution and then extracting the precipitate with a liquid which is a solvent for only part of the ether treated. The extraction liquid may be one which dissolves the fractions of higher clarity leaving the less valuable fractions undissolved, but it is preferred to employ a liquid that dissolves the low-clarity fractions and leaves the fractions of higher clarity undissolved. The extraction may be repeated until no further substantial improvement in the clarity of the product occurs. Ethylcellulose having an ethoxyl content of about 40 to 50 per cent., which is soluble in a mixture of toluene and ethyl alcohol, may be dissolved in a lower fatty acid, e.g. acetic acid, precipitated by the addition of water, and then extracted with an aqueous solution of the fatty acid. C.

**Yarn Dyeing Apparatus.** T. Welch. B.P.556,689 of 10/4/1942:18/10/1943. A machine for applying liquids to yarns comprises two rollers, one above the other with suitable means of rotation and compression, divided into longitudinal sections each isolated from the other to prevent creep of the liquid along the roller, each section being opposite a dye or colour bath isolated from the adjacent bath or baths, the yarn being drawn through the bath containing the required colour and squeezed between the rollers, surplus liquid being removed and returned to the bath by a doctor blade. Creep of the liquid along the rollers is prevented by an arrangement of alternating grooves and flanges at the ends of the roller sections, running in one another. C.

**Phenol-aldehyde Coated Rubberised Sheet Material: Production.** E. I. Du Pont de Nemours & Co. B.P.556,710 of 16/3/1942:18/10/1943 (Conv. 14/3/1941). A rubber surface, if desired after application of a thin film of a resin, e.g. shellac, is treated with a halogen or halogen compound adapted to harden it, e.g. sulphur chloride, and there is subsequently applied a film comprising a phenol-aldehyde resin, preferably by applying a coating composition including a volatile constituent and adapted on evaporation to deposit a film comprising a phenol-aldehyde resin. The phenol-aldehyde resins are applied in their partly condensed forms known as resoles and the coating composition preferably also includes other film-forming materials such as cellulose esters and alkyd resins, particularly those modified with non-drying oils. The coating may be air dried, but best results are obtained by baking. Pigments, fillers, dyes, plasticizers, etc., may be incorporated in the coating compositions. Coatings may be applied to rubber coated fabrics, moulded rubber articles and various rubber coated articles. The protective coatings formed by this method are of unusual durability and of exceptionally high adherence, and abrasion and oil resistance. C.

**Formal-type Condensation Products: Production.** British Celanese Ltd. B.P.556,756 of 17/4/1942:20/10/1943 (Conv. 17/4/1941). The production of condensation products of the formal type by reaction between an aldehyde and an aliphatic hydroxy compound is carried out by a process which comprises introducing a mixture of the aldehyde and the aliphatic hydroxy com-

pound under a substantial layer of the aliphatic hydroxy compound and heating to above the mean reaction temperature. Preferably the mixture of aldehyde and aliphatic hydroxy compound is introduced in at least five decrements, the temperature of the liquid in the reaction zone being heated to above the mean reaction temperature before each addition. Details are given of the application of the method to the production of a condensation product from ethylene glycol monomethyl ether and formaldehyde. C.

**Wool: Treatment to Prevent Shrinking.** Wolsey Ltd. and E. R. Trotman. B.P.556,872 of 11/6/1942:26/10/1943. Material composed wholly or partly of wool is made resistant to shrinkage by treatment in a solution of chlorine or bromine in an indifferent solvent. The chlorine or bromine may be dissolved in a relatively small volume of carbon tetrachloride or other suitable organic liquid and the solution diluted with another solvent such as white spirit. Before treatment, the wool should be conditioned to a moisture content of about 13 per cent. After treatment, the material is rinsed in an aqueous solution containing a sulphonated fatty alcohol and sodium carbonate or sodium sulphite. C.

**Nylon Fibre: Treatment to Improve Affinity for Direct Dyes.** Courtaulds Ltd. and C. C. Wilcock. B.P.556,925 of 22/4/1942:27/10/1943. A process for improving the dyeing affinity of nylon fibres for direct cotton dyes in an acid bath comprises pre-treatment with an aqueous solution containing about 1 per cent. of a water-soluble salt of Cu, Ag, Li, Ba, Sr, Ca, Mg, Zn, Al, Ce, Sn, Pb, Cr, Fe, Ni or Co. The fibres may be treated in continuous or short lengths, loose or twisted into thread, or in the form of fabric. C.

**Abrasive Sheets: Production.** A. Abbey (United Cotton Products Co., Fall River, Massachusetts, U.S.A.). B.P.557,038 of 27/1/1942:2/11/1943. An abrasive article comprises a web formed from a number of superposed carded fibrous membranes, the individual fibres of which are interlocked, interlaced or interwoven with the fibres of the adjacent membrane or membranes so as to form a non-laminated web structure provided with interstices in which abrasive grains are anchored by the interlocking action of the fibres. Methods of forming the fibrous web and of introducing the abrasive grains are described. The abrasive grains may be additionally anchored in the web by means of a resilient waterproof adhesive, e.g. latex. An additional surface layer of abrasive grains may be applied to the surface of the abrasive web. C.

**Resinous Coating Compositions: Production.** E. I. Du Pont de Nemours & Co. and W. Nebel. B.P.557,046 of 29/4/1942:2/11/1943. A solution of a resinous inter-condensation product is prepared by partially inter-condensing a partial condensation product of a urea and/or an aminotriazine and an aldehyde with a partial condensation product of a ketone and an aldehyde, in the presence of an excess of a lower aliphatic monohydric alcohol. The inter-condensation is preferably carried out in the presence of an acidic catalyst, e.g. phthalic anhydride. The ketone preferably contains at least one unsubstituted methyl group directly attached to the carbonyl group. Solutions prepared in this way may be used as coating compositions for the production of protective and decorative finishes on metal, wood, glass, plastics, fabrics, leather, etc., and as adhesives, and impregnating and insulating compositions. C.

**Wear Resistant Textile Materials: Finishing.** Tootal Broadhurst Lee Co. Ltd., E. Battye, S. E. Lawton, J. T. Marsh and F. C. Wood. B.P.557,067 of 29/1/1942:3/11/1943. The wear resistance of textile materials is increased by impregnating them with an aqueous dispersion of a co-polymer of an alkyl acrylate or methacrylate and less than 15 per cent., preferably less than 7 per cent., of a compound containing two  $\text{CH}_2:\text{C}<$  groups separated by at least one intermediate atom, obtained by co-polymerising a mixture of the compounds in aqueous emulsion in presence of a polymerisation catalyst, and drying the impregnated material. Suitable compounds of the specified type are methylene, ethylene and trimethylene glycol diacrylates and dimethacrylates, ethylidene diacrylate and dimethacrylate, divinyl acetylene, symm. divinyl ethylene, divinyl ether, divinyl sulphone, and paravinyl benzene. C.

**Monoazo Dyes: Production.** A. H. Knight, W. F. Stephen and Imperial Chemical Industries. B.P.557,100 of 2/2/1942:4/11/1943. Monoazo dyes for wool and silk are made by diazotising an amine of the general formula  $\text{X.CO.NY.R.NH}_2$ , in which R stands for a *m*- or *p*-phenylene residue which may carry simple azo dye substituents, e.g. methyl, alkoxy or sulphonic groups,

but does not contain a carboxylic acid group in *o*-position to the primary amino group, X stands for a mono-chloro- or mono-bromo-alkyl radical ( $C_1-C_6$ ) and Y stands for hydrogen or alkyl (containing 1-6 C atoms and devoid of sulpho groups), and coupling the diazo compound with 1-amino-8-naphthol-(4 or 6)-monosulphonic acid or 1-amino-8-naphthol-(3:6 or 4:6)-disulphonic acid, wherein one amino hydrogen is substituted by an acyl group  $-CO$ -alkyl ( $C_1-C_6$ ) and the other, if desired, by an alkyl radical. The dyes dye wool from an acid bath in various shades of red, affording dyeings of very good fastness to severe washing and milling and good fastness to light. C.

**Flexible Waterproof Fabrics: Production.** C. L. Wall. B.P.557,161 of 22/12/1941:8/11/1943. A method for the production of waterproof fabrics that are flexible at low temperatures and do not become tacky at summer sun temperatures comprises first impregnating the fabric with a water-repelling material which will be flexible at normal temperatures and then coating it with a second water-repelling material which is not miscible with the first material and which does not become tacky when exposed to the sun. Impregnating material containing an oil or grease and coating material containing coumaron resin are used. Examples of suitable combinations of impregnating and coating material are (a) a mixture of mineral oil and petroleum jelly coated with a mixture of hard coal tar pitch and coumaron resin, and (b) a mixture of naphthenic acid and black cottonseed grease coated with a mixture of poly-ethylene and coumaron resin. Fungicides and bactericides may be added to the impregnating and/or coating baths; penta-chlorophenol, copper naphthenate or mercuric naphthenate are effective. C.

**Washable Water-repellent Textiles: Production.** Pond Lily Co. U.S.P. 2,323,387. A water-repellent effect that resists the action of strong alkaline detergents is obtained by impregnating the cloth with a salt of Al, Zr, Ce, Th, Cr, Ni, Pb, Ba, or Ti, drying, treating with alkali to precipitate the metallic hydroxide, and then depositing a coating of wax on the fibres. C.

**Tracing Cloth: Production.** Frederick Post Co. U.S.P.2,323,469. The surface of the cloth is treated with a waterproofing lacquer that contains more of an oil, fat or wax than the lacquer film can hold on drying, the excess being rejected into the cloth to make it transparent. C.

**Textile-covered Strand Coating Device.** Western Electric Co. U.S.P. 2,323,487. The device consists of a pair of rollers, the lower one having a peripheral groove and dipping into the bath of coating material and the upper one having a tongue that works in the groove of the lower roller and thus maintains alignment. A wall of the groove and the corresponding wall of the tongue have recesses that together form a die through which the covered strand passes and receives its coating. C.

**Roller Cover.** Helene E. Uhlig. U.S.P.2,323,580. The roller is wrapped a number of times in a strip of fabric with elastic selvages. C.

**Rubber Products: Application in Printing Pastes.** Interchemical Corporation. U.S.P.2,323,591. A textile printing paste consists of a colour dispersed in a solvent dispersion of a depolymerized rubber and up to 50 per cent. (on the rubber) of a chlorinated rubber, this reducing the tackiness. C.

**Photo-electric Stamping Machine Control Device.** Paramount Textile Machinery Co. U.S.P.2,323,843. The wiring plan is shown of a stamping machine in which the mechanism for marking the fabric is controlled by a clutch, a solenoid and a photo-electric cell illuminated by a source that is interrupted by the fabric when placed in position. C.

**Cellulose Caprate Adhesive Sheet.** Eastman Kodak Co. U.S.P.2,324,097. Cellulose caprate is claimed for use as an adhesive sheet. The specification includes a graph of the melting points of cellulose esters plotted against the number of C atoms in the fatty acid radical. There is a sharp fall from  $C_7$  to  $C_6$ , but the  $C_6$  and other esters up to  $C_{18}$  all melt within the range of about 80-95° C. C.

**Fur: Carrotting.** C. F. Fabian (to The Non-Mercuric Carrot Co.). U.S.P. 2,306,872 of 29/12/1942 (through *Chem. Abs.*, 1943, 37, 3620). Fur, e.g. rabbit fur while on the skin, is treated with a mixture consisting of a relatively heavy powdered penetrating material, e.g. a ground abrasive, a relatively light finely-divided absorbing material, e.g. sawdust, ground sponge or asbestos, and

a carrotting solution absorbed by the absorbing material, both the absorbing and penetrating materials being non-reactive to the carrotting solution. W.

**Mothproofing Compositions.** A. L. Flenner and A. H. Goddin (to E. I. Du Pont de Nemours & Co.). U.S.P.2,307,775 of 12/1/1943 (through *Chem. Abs.*, 1943, 37, 3620). *N,N*-dimethyloctadecylamine or a similar compound, e.g. one of general formula  $R^2(CH_2)_{13}NR^1R^2$ , is used as the active ingredient, preferably in a dry cleaning solvent. W.

**Fur: Carrotting.** W. Page. U.S.P.2,309,254 (through *J. Amer. Leather Chem. Assoc.*, 1943, 38, 204). A carrotting composition consists by weight of 3-8 per cent. zinc sulphate, 8-15 per cent. acetic acid (28 per cent.), 6-8 per cent. tannic acid, 2-10 per cent. nitric acid (specific gravity 1.530), 3-10 per cent. sulphuric acid (66° Be.) and 3-8 per cent. hydrogen peroxide (100 vol.). W.

**Esters of Hydroxypolyarylmethanes: Mothproofing Agents.** H. A. Bruson (to The Resinous Products & Chemical Co.). U.S.P.2,309,335 of 26/1/1943 (through *Chem. Abs.*, 1943, 37, 3858). The products of the treatment, in the presence of an acidic catalyst, of a carboxylic acid ester of a monocarboxylic-acyloxymethyl phenol with an aromatic compound having a reactive nuclear hydrogen atom, are useful mothproofing agents. W.

**Hair of Sheepskins: Setting.** P. Kestenbaum. U.S.P.2,309,907 of 2/2/1943 (through *Chem. Abs.*, 1943, 37, 4260). The hairs are treated with a glyceride of a fatty acid, e.g. castor oil, linseed oil, sperm oil and Turkey Red oil, and a formaldehyde solution, and subsequently heated to form a water-insoluble product. W.

**Hair: Composition for Permanent Waving.** G. Friedman and A. R. Goldfarb (to Lawrence R. Bruce, Inc.). U.S.P.2,310,687 of 9/2/1943 (through *Chem. Abs.*, 1943, 37, 4166). The composition, which is a homogeneous emulsion ranging from a free-flowing to a pasty consistency, contains a fatty alcoholic adsorbent medium having  $>12$  C atoms, e.g. cetyl or stearyl alcohol, a fatty ester dispersing agent, e.g. lanolin, a sulphite "waving principle," e.g. sodium sulphite, and a hydrolysable supporting colloid, e.g. wheat starch. The composition is stable over normal climatic ranges, and on the application of heat, forms on the hair a protective and porous coating which permits the penetration of the steam and vapour of the "hair waving principle," and also retains the natural oil and moisture of the hair. W.

**Milling Machine Stop Motion.** J. W. Peace. B.P.556,715 of 19/10/1943. The machine is stopped from 3 positions: (1) The breast roller stops the machine if the fabric slips in the main rollers; (2) the draft board; (3) a cross bar above the breast roller prevents the operative's hands from being drawn into the machine. The mechanism is spring loaded in the off position, the spring being held out of action by a trigger operated from the above positions. W.

**Wool: Rendering Unshrinkable.** Wolsey Ltd. and E. R. Trotman. B.P.556,872 of 26/10/1943. Material composed wholly or partly of wool, and containing 13 per cent. moisture, is made resistant to felting by treatment at 15-20° C. with chlorine or bromine dissolved in an inert organic solvent. The time of immersion is 1 hr. for chlorine and 3 hr. for bromine. The treated material is rinsed in an aqueous solution containing a sulphonated fatty alcohol and sodium carbonate or sodium sulphite. In examples, wool (5 lb.) is immersed in either (1) 0.125 lb. gas in 1000 c.c. carbon tetrachloride and 5 gal. white spirit, or (2) 0.15 lb. bromine in 1000 c.c. carbon tetrachloride and 5 gal. white spirit. Alternatively a mixture of 80 parts by vol. white spirit and 20 parts by vol. carbon tetrachloride or other organic solvent, to which chlorine is passed through a measuring apparatus, may be used. W.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Fibres: Capture of Air-borne Particles.** E. F. Burton. *Nature*, 1943, 152, 540. An electron microscope picture ( $\times 1000$ ) of a collection of fine sodium chloride crystals clinging to a fine rubber fibre is reproduced. Sodium chloride solution had been sprayed with an atomizer into air which was drawn past the fine fibre (about  $0.7\mu$  in diameter). A photograph is also given of a drawing obtained by projecting the negative on a wall screen and sketching in the apparent boundaries of the individual crystals. C.

**Pe Ce and Perlon Fibres: Properties.** *Industrial Chemist*, 1943, 19, 572-574. Pe Ce fibres, derived from polyvinyl chloride, are, according to German claims, of unsurpassed resistance to acids, alkalis, and oxidising and reducing media. They are not affected by long contact with water and do not develop mildew. Their electrical insulating properties are better than those of silk. When brought into direct contact with a flame they melt but solidify again when the flame is removed. The low softening point of 85-90° C. of the fibres does not allow textile materials made from them to be boiled or ironed in the usual way. Important uses of Pe Ce fibres are for the production of filter media, protective coverings, belts, cords, insulating materials, and fishing nets. Perlon is a polyamide material which shows a resistance to chemical reagents superior to that of natural fibres but not as extraordinary as that of Pe Ce fibre. Its tensile strength is 50 per cent. higher than that of silk, over three times that of cotton, and about nine times that of wool. Its elasticity exceeds that of wool and silk, its resistance to flexure is many times that of silk, and it stands up exceedingly well to the severest scouring and resists sea water for years. Perlon does not rot or mildew, and is not attacked by moths or termites. The absorptivity varies with the type of the fibre. All types of Perlon fibres can be boiled and ironed if care is taken; in ironing the use of a wet covering cloth is recommended. Perlon fabrics have very good wearing qualities, and mixtures of 20-30 per cent. of Perlon with other natural or artificial fibres greatly enhance the wearing qualities of the latter. Actual wear tests of silk and Perlon stockings of similar construction and of woollen, cotton, and Perlon socks have demonstrated the superior wearing qualities of Perlon. C.

**Compressed Fibres: Microscopic Investigation of Structure.** F. H. Müller and Wallner. *Beiheft Z. Ver. deut. Chem.*, No. 45; *Die Chemie*, 1942, 55, 65 (through *Chem. Abstr.*, 1943, 37, 5595<sup>3</sup>). Photographs were prepared from fibres which, after swelling in a suitable agent, were squeezed between glass plates by a special press. These preparations showed the characteristic structures of the various fibres. In natural fibres containing cellulose the spiral construction was clearly demonstrated. The corresponding artificial fibres, depending upon the degree of stretching, showed skein-like cleavage with more or less good orientation. The polymerization degree, the precipitation conditions and a possible hardening of the fibres are recognised in the photographs. Casein fibres, similarly treated, likewise showed characteristic differences, whereas completely synthetic fibres appeared more or less as a plastic mass. C.

**Rayon Staple: Properties.** J. Jensen. *Ingeniren*, 1942, 51, No. 27, K 25-28 (through *Chem. Zentr.*, 1942, ii, 1306-1307 and *Chem. Abstr.*, 1943, 37, 5595<sup>6</sup>). A discussion of the differences, from the textile point of view, between cotton, wool and rayon and a description of the behaviour of rayon staple toward water. C.

**Regenerated Cellulose Filaments: Retraction on Swelling.** P. H. Hermans, A. J. de Leeuw and P. Platzek. *Cellulosechemie*, 1941, 19, 117-122 (through *Chem. Zentr.*, 1942, ii, 1351 and *Chem. Abstr.*, 1943, 37, 5859<sup>9</sup>). Freshly prepared isotropic cellulose xanthate filaments ( $q=13.4$ ) were extended to various values for  $\nu$  in 2N ammonium sulphate as swelling medium. Subsequent immersion in 0.5N. sodium sulphate solution caused some swelling and contraction, after which the samples were introduced again into ammonium sulphate and measurements made after equilibrium had been reached. Stretched cellulose hydrate and xanthate, subjected to this additional swelling, shrank appreciably. The shrinkage occurred only when  $q$  of the processed filaments exceeded that originally manifested by these filaments at the time of extension. It is termed "retraction due to swelling." The greater the post-swelling, the greater the magnitude of this retraction, which appears to be a reversal of the deformation process. The change in volume that accompanies the extension of swollen filaments, as well as their swelling anisotropy and their specific double refraction, are reversed and sharply correlated with the amount of shrinkage. When swelling becomes extreme, in filaments that are markedly orientated, their anisotropy is destroyed completely. C.

**Swollen Isotropic Cellulose Filaments: Volume Changes on Stretching.** P. H. Hermans. *Cellulosechemie*, 1941, 19, 122-124 (through *Chem. Zentr.*, 1942, ii, 1350 and *Chem. Abstr.*, 1943, 37, 5859<sup>9</sup>). When extended, filaments of swollen cellulose xanthate and of hydrated cellulose suffer a marked decrease in volume, and the specific decrease is proportional to the specific extension.



In either case the proportionality factor is 0.58; the Poisson coefficient for infinite extensibility is approximately 1.0. Curves, in which the course of the degree of swelling ( $q$ ) is represented as a function of the degree of extensibility ( $v$ ) are actually straight lines that intersect at  $q=0$ , and  $v=2.7$ . When re-swollen filaments are stretched at  $q=2.5$ , the volume increases at first by 40 per cent. and then drops to the original value. The author seeks to explain these data on the basis of tri-dimensional net-like structures with permanent points of contact. The influence of the time factor during the period of extension is discussed. C.

**Swollen Nitrocellulose Filaments: Double Refraction.** D. Vermaas. *Z. physikal. Chem.*, 1942, B 52, 131-141 (through *Chem. Abstr.*, 1943, 37, 5301<sup>8</sup>). A fourth component of double refraction appears in swollen nitrocellulose filaments. C.

**Silk Fibroin: Structure.** E. Abderhalden. *Z. physiol. Chem.*, 1943, 277, 248-250 (through *Chem. Abstr.*, 1943, 37, 5595<sup>7</sup>). Under conditions which exclude a secondary formation from polypeptides, silk fibroin forms, in partial hydrolysis, an optically inactive glycylalanine anhydride. The regular appearance of *dl*-alanine among the products of total hydrolysis of the protein mentioned is attributed to the splitting up of these amino acid-containing diketopiperazines. It is suggested that they may be contained in albumen in the enol form. C.

**Silk Fibroin Amino Acids: Determination by Solubility Product Method.** S. Moore and W. H. Stein. *J. Biol. Chem.*, 1943, 150, 113-130. The principle of the solubility product method of analysis is explained, and details are given of the procedures for the determination of glycine and *l*-leucine on a semi-micro scale in protein hydrolysates. 5-Nitronaphthalene-1-sulphonic acid is used for the determination of glycine and 2-bromotoluene-5-sulphonic acid for the determination of leucine. Results of determinations of these compounds in pure solutions, in synthetic mixtures of amino acids, and in hydrolysates of egg albumin, gelatin, collagen and silk fibroin are tabulated and discussed. The data indicate that gelatin and collagen each contain about 3.5 per cent. of *l*-leucine and 25.5 and 26.5 per cent., respectively, of glycine, whilst the fibroin contains about 0.8 per cent. *l*-leucine and about 44 per cent. glycine. C.

**Jute: Moisture Relations.** A. Powrie and J. B. Speakman. *J. Textile Inst.*, 1943, 34, T 77-86. Eleven samples of jute of known commercial quality were analysed for cellulose content, xylan content of the cellulose, furfuraldehyde yield, and lignin content. Although the lowest qualities were found to have the highest and lowest contents of lignin and cellulose, respectively, no simple connection between constitution and quality could be established. Adsorption and desorption isotherms were determined at 25° C. with six of the samples, selected so as to include two samples each of white jute of high and low quality, one sample of red jute, and a sample of *Hibiscus cannabinus*, a jute substitute. In all cases, the adsorption and desorption isotherms, between which there is considerable hysteresis, are sigmoid in shape. Different kinds of jute differ considerably in their affinity for water, and there is a general tendency for the regain at any particular humidity to increase with increasing xylan + lignin content. As would be expected, therefore, the jute of highest quality was found to possess the lowest affinity for water. In addition, one of the two samples of poor quality had the highest affinity for water, and although the second sample had a lower affinity than the first, this lower affinity was higher than that of any of the samples of better quality. C.

**Wool: Reactions and Determination in Presence of Silk and Cotton.** P. Torti. *Boll. chim.-farm.*, 1942, 81, 57 (through *Chem. Zentr.*, 1942, ii, 1418 and *Chem. Abstr.*, 1943, 37, 5595<sup>5</sup>). Reactions with picric acid are described. C.

**Wool: Electron Microscopy of Isolated Spindle Cells.** H. Zalm. *Textilber.*, 1942, 23, 157 (through *Chem. Abs.*, 1943, 37, 4577). Cells isolated by trypsin frequently have one end shaped like a two-pronged fork, the prongs being approx. 10  $\mu$  long and 1  $\mu$  wide and the ends of the prongs being split into fibrils approx. 100 m $\mu$  thick. Powdered wool fibres, prepared by crushing in a steel mortar when cooled by liquid air and then dispersed in water by ultrasonic waves (10,000 cycles per sec.), produced images showing irregularities in the fracture surfaces, indicating that most of the spindle cells are composed of units of a size similar to the above-mentioned fibrils. W.



## (B)—YARNS

**American Rayon Yarns: Denier and Filament Numbers.** H. R. Mauersberger. *Rayon Textile Monthly*, 1943, 24, 455-6, 464-5, 477. (1) A table shows the makers, process, trade names, deniers and filament numbers of high tenacity rayon yarns now being produced in the United States. (2) A revised table shows the makers, brands, deniers and filament numbers of rayon yarns now produced in the United States. The viscose process accounts for 117 items by 13 firms, acetate for 39 by 5 firms, cuprammonium for 9 items by one firm, and Vinyon for 6 items by one firm. The trends are discussed. (3) A revised table gives similar particulars of current American rayon yarns for fully-fashioned hosiery. C.

**Cellulose Acetate Yarn: Application for Electrical Insulation.** D. R. Brobst. *Bell Lab. Record*, 1942, 20, No. 5 (through *Rayon Textile Monthly*, 1943, 24, 467-8). Brief notes are supplied about recent developments in the substitution of tussah silk by cellulose acetate yarn, in wrapping wires for electrical insulation. A common type of wire for switchboard work is now made with two wrappings of acetate yarn and one of cotton, and finished with a coating of cellulose acetate lacquer. The superiority of acetate rayon over silk and cotton (washed and unwashed) is shown by some graphs that reflect the fluctuations with atmospheric humidity over 9 days of insulation resistances (1) of threads stretched between electrodes and (2) between two wires of a twisted pair. C.

**"Fortisan" Rayon Yarn: Properties.** W. Whitehead. *Rayon Textile Monthly*, 1943, 24, 456. "Fortisan" is described as a regenerated cellulose yarn with highly orientated micelles, made by the Celanese companies. Current production is in 30 den. and upwards, 0.7 den. per filament, but filaments finer than 0.1 den. have been spun. The strength is more than 7 gm. per denier, dry, and 6 gm., wet, and the extension at break is 6.0-6.5 per cent. The specific gravity is 1.5. The ratio (strength in lb. per sq. in.)/(specific gravity) is 92,000, compared with 8,000 for un-annealed iron wire and 10,400 to 42,300 for steel. C.

## (C)—FABRICS

**Cellulose: Oxidative Fission; Measurement.** S. A. van Hoytema. *Polytech. Weekblad*, 1942, 36, 139-141 (through *Chem. Zentr.*, 1942, ii, 1419 and *Chem. Abstr.*, 1943, 37, 5860). Whilst oxidative fission is considered desirable for good operation in rayon manufacture, it must be avoided as far as possible with fabrics, yarns and paper (e.g. in bleaching and washing). Methods for determining the degree of fibre damage in various types of treatment are discussed. C.

**Supersonic Tyre Testing Device.** Goodyear Tyre and Rubber Co. *Engineer*, 1943, 176, 394. In a device for locating air spaces caused by the separation of the layers of fabric composing a tyre, the tyre is dismantled from the rim and is hung on two rollers in such a way that the bottom portion passes through a shallow tank of water as the tyre is revolved. Sound waves of supersonic frequency are generated in the water by a nickel rod, set in vibration by means of a high-frequency electric current, which passes through a coil of wire surrounding the rod. The vibrations are picked up by a microphone, mounted so as to be always inside the portion of the tyre which is immersed in the water. The microphone operates a relay box equipped with a green and a red light. As long as the tyre is solid, the supersonic vibrations pass through it with full intensity to the microphone and cause the green light to stay lit. If there is a separation in the tyre, the supersonic waves are reflected back by the air gap and as a result of the reduced intensity passing through the tyre the green light goes out and the red light appears. C.

**Quality Control after the War: Application to Textiles.** B. H. Wilsdon. *Wool Rec.*, 1943, 64, 601, 603. Address to the Bradford Textile Society. The maintenance of standards by the producer through systematic testing is a highly-developed system widely practised in engineering and, with suitable modifications, would find application after the war in all industries, including textiles. The use of a certification mark is advocated. In the discussion, Mr. Hunter considered that it would be impossible to set certification standards for the whole of the wide variety of wool fabrics and materials produced, but that there was an excellent opportunity for the introduction of such standards to utility fabrics. W.

## (D)—OTHER MATERIALS

**Plastic Materials: Photo-elastic Investigations.** H. Kolsky and A. C. Shearman. *Proc. Phys. Soc.*, 1943, 55, 383-395. An account is given of investigations of the orientation and structural changes in polythene, nylon, methyl methacrylate polymer, and polystyrene resulting from the application of known stresses by measurements of the optical anisotropy induced. The mechanism of cold-drawing of polythene and nylon is considered in detail and the birefringence correlated with the mechanical strain. The stress/birefringence curves for these two materials comprise a short linear portion followed by a rapid rise and then by a flat portion where no appreciable change in birefringence with load is detected. In the case of nylon the application of stresses of about 200 kg./cm.<sup>2</sup> at 20° C. appears to deform the material to a critical state in which the restoring forces are just able to overcome the deformation when the stress is removed. Any further increase of stress produces large permanent strains. The birefringence of nylon for a given applied stress increased on heating. The increase of the birefringence of polythene and nylon during cold-drawing appears to indicate that a gliding re-arrangement of the crystalline micellar groupings takes place in this region and that it may be possible for new crystalline groupings to be formed from the "tie-molecules." The birefringence effects observed with methyl methacrylate polymer and polystyrene indicate that small sections of the side chains become aligned along the direction of stretching and orientate the side groups accordingly. Increasing the temperature of the specimens decreases the extent of this orientation. C.

**Rubber: Ageing; Influence of Exposure to Light.** J. R. Scott. *J. Rubber Research*, 1943, 12, 87-90. Tests were made with lightly compounded rubbers and rubbers heavily compounded with carbon black and zinc oxide. Vulcanised slabs were exposed to light and similar slabs were kept in the dark. Bomb ageing and Geer oven ageing tests were carried out, and tensile strength and other properties were determined before and after exposure to light and ageing. The data are tabulated. They show that exposure of vulcanised rubber to light may affect the results of oxygen bomb ageing tests made some days, or perhaps even weeks, afterwards, and that a few days' exposure to even diffused daylight may noticeably lower the tensile strength of the unaged rubber. With normal, i.e. not transparent, rubbers the effect of light on subsequent ageing is small in the bomb tests and does not seem to be noticeable in relatively slow ageing tests such as Geer oven tests. However, it is advisable to avoid unnecessary exposure to light of rubbers that are to be subjected to accelerated ageing tests. C.

**Rubber: Resistance to Abrasion.** H. A. Daynes. *J. Rubber Research*, 1943, 12, 90-92. Tests were made on vulcanised rubber from three mixings, the test specimens being in the form of discs of 2.5 in. outside diameter. Two machines were used in which the discs rotated in contact with abrasive wheels at speeds of 62 r.p.m. and 244 r.p.m., respectively, the corresponding peripheral speeds being about 12.4 m. and 49 m. per min. Volume losses were determined. The results show that the use of the higher speed accelerates testing on account of both the higher rate of revolution and an observed higher loss per revolution of the wheel. The higher speed may be expected to give a more accurate idea of the behaviour of a tyre tread rubber under service conditions. This might be considered a disadvantage in testing rubbers for other purposes, such as shoe soles, but the results obtained suggest that there will be no serious disturbance of relative values in adopting the higher speed for all purposes. C.

**Rubber: Water Sorption.** H. Veith. *Kolloid Z.*, 1942, 98, 52-62 (through *Sci. Abstr.*, 1943, A 46, 170). The relation found empirically, that the quantity of water absorbed by technical rubber is proportional to  $\sqrt{t}$ , is explained theoretically under the assumption that the speed of sorption is proportional to the difference of external and internal vapour pressure, the latter following Raoult's law. The influence of elastic tension is discussed and found to be negligible with rubber, but not with substances having a higher degree of swelling, e.g. gelatin. Here the pressure of swelling is partially compensated by the elastic tension and this accounts for the non-linearity of the function (pressure of swelling)/concentration. C.

**Cellulose Acetate Sheet: Mechanical Tests.** W. N. Findley. *Trans. Amer. Soc. Mech. Engrs.*, 1943, 65, 479-487 (through *Chem. Abstr.*, 1943, 37, 5860<sup>a</sup>). Tests on cellulose acetate were carried out at 77°F. and 50 per cent. R.H.

Repeated bending (fatigue) tests were made at different speeds of testing and different ranges of stress, which demonstrate that both of these variables are important. The effect of different shapes of fatigue specimens (circular, square and rectangular cross section) on the endurance limit is also discussed. Static compression tests of preconditioned specimens tested at intervals of time up to 10 months show the effect of initial moisture content and time on the yield point and weight. Static torsion (tension and compressed) conducted at the same rate of strain indicate the effect of rate of strain and type of loading on the strength properties of the material. Static tension tests on a specimen containing a transverse hole show the effect of a stress concentration on the tensile strength. The results are given in 10 curves. C.

**Pulp: Specific Surface; Determination.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1943, 117, TAPPI, 141-144. The specific surface of pulp is defined as the exposed area in sq. cm. per g. of moisture-free sample and provides a measure of the degree of fineness or fibrillation. This surface may be determined by treating a weighed sample of the pulp, which has been freed from lumps and fibre bundles, with a hot ammoniacal silver nitrate solution, washing the silvered sample, suspending it in water containing a borate buffer solution, adding a known volume of hydrogen peroxide solution, stirring, acidifying with dilute sulphuric acid, and titrating with standard permanganate solution. Details of the procedure, apparatus and reagents are given, together with a calibration chart showing the relation between permanganate used and surface of sample. C.

**Fiberglas Laminated Plastics: Physical Properties.** C. W. Armstrong. *Iron Age*, 1943, 152, No. 4, 51-54 (through *Chem. Abstr.*, 1943, 37, 5512<sup>b</sup>). Fiberglas fabric is laminated with thermo-hardening resins which are unique in that no external pressure is required during the process of moulding a plastic part. The laminate is hardened by the application of heat at temperatures seldom exceeding 240° F. Parts having intricate shapes and double contours may necessitate the use of light pressure (0.1 to 10.0 lb. per sq. in.), to keep the impregnated fabric material in intimate contact with all surfaces of the mould and to prevent free resin from accumulating in localised spots. Because of the low pressures, moulds may be simple, light in weight, and inexpensive. Tensile strength runs from 34,000 to 105,000 lb. per sq. in., elongation from 1.8 to 2.9 per cent., ultimate compressive strength from 16,900 to 29,000 lb. per sq. in., modulus of rupture in bending from 34,900 to 64,800 lb. per sq. in., and modulus of elasticity in bending from 1,630,000 to 5,950,000. The physical properties are greatly influenced by the arrangement of the lamina and by the relative properties of Fiberglas and resin. C.

**Plastics: Specification and Testing.** American Society for Testing Materials, Committee D.20. *A.S.T.M. Standards on Plastics*, 1943, 431 pages. This volume, like the companion handbook on Textiles, collects together all the specifications and tests put forward by the Society. There are 8 tentative specifications for moulding compounds, 4 for sheets, rods and laminates, 4 for non-rigid plastics, 2 for radio applications, 57 for methods of testing and specifying test conditions, and 5 covering nomenclature and definitions. C.

**Plastics: Structure and Physical Properties.** R. F. Tuckett. *Chemistry and Industry*, 1943, 62, 430-432. Any general deformation of a plastic is shown to comprise the sum of (a) a deformation due to the stretching of the individual links or change in the angle between adjacent links in the molecular chain, (b) a deformation due to change in chain orientation, and (c) a deformation due to whole portions of chains sliding over each other. The effects of temperature, size and structure on these three components are briefly considered. Brittleness, toughness, and hardness, empirical tests used to determine these properties, and various softening point tests are discussed in terms of these ideas of deformation. C.

**Rubber: Elasticity.** L. R. G. Treloar. *Trans. Inst. Rubber Ind.*, 1943, 18, 256-365. Theories of the elasticity of rubber are critically discussed, and the kinetic theory and its application to bulk rubber are studied. The kinetic theory, though requiring modification and amendment in its application to real materials, does provide a better understanding of the phenomenon of rubber-like elasticity than any other theory yet advanced, because the assumptions on which it is based are in accordance with the known chemical properties of molecules. C.

**Rubber: Oil Absorption.** G. Gee. *Trans. Inst. Rubber Ind.*, 1943, 18, 266-281. Changes in entropy and energy when two liquids are mixed are studied and conditions for mixing are defined. It is shown that the absorption of oil by rubber may be regarded as the mixing of two liquids, rubber and oil, and that absorption results from an increase in entropy brought about by the natural tendency of the molecules to mix by thermal motion. The fact that the phenomenon of swelling is observed has nothing to do with any attractive forces between rubber and oil; it is rather a visual indication of the extent to which the rubber molecules themselves cohere. The swelling of rubber in different liquids and the dependence of the swelling on heat of swelling, molecular volume and cohesive energy density are discussed. The swelling of synthetic rubbers in various liquids is also discussed. C.

## 7—LAUNDERING AND DRY-CLEANING

### (A)—CLEANING

**White Discharged Viscose Rayon: Tendering by Perborate Washing Agents.** W. Taussig. *J. Soc. Dyers & Col.*, 1943, 59, 217-218. A report is given of investigations of a case of tendering of the white discharged parts of a garment made up from a fabric having viscose rayon warp, rendered mat in the filament with titanium dioxide, and Fibro weft, dyed with Diazamine Blue EBR(S.), diazotised and developed with  $\beta$ -naphthol, and discharged with 150 g. of Formosul and 100 g. of zinc oxide per litre. The fluidities of the warp and weft were considerably higher in the white discharged parts than in the dyed ground. Unsuccessful attempts to reproduce the increased fluidities in the processing of similar fabric indicated that the tendering did not occur in the factory. As the garment had been washed, the effect of repeated domestic washing, particularly with modern washing agents containing per-salts under extremely severe conditions was examined on a reference pattern from normal production. It was found that when a white discharged material is given a washing treatment at too high a temperature with an agent containing a per-salt, although the dyed ground is tendered only to a slight degree, the white discharge may be so strongly attacked that, in the wet state, it may lose as much as 80 per cent. of its original dry strength. In tests on undyed and dyed material without discharge, it was found that, after perborate treatment, the fluidity of the dyed material was lower than that of the undyed material, and from this the conclusion was drawn that the dye is more easily oxidised than the viscose rayon and so exerts a protective action against the attack of the oxidising agent on the fibre. When Formosul was printed, with and without zinc oxide, on white material, the increase of fluidity after perborate treatment, particularly when the printing paste contained no zinc oxide, was greater on the printed part than on the white ground. A white discharge printed on a dyed material, after perborate treatment showed a slightly higher fluidity than the same white discharge printed on a similar undyed material. C.

**Soap: Solid Phases.** See Section 9.

**Saponin: Applications.** H. J. Henk. *Zellwolle, Kunstseide, Seide*, 1942, 47, 131 (through *Chem. Abstr.*, 1943, 37, 5870<sup>a</sup>). The cleaning properties of saponin are due to negative electrostatic charges that peptize the dirt particles. The addition of 0.5-1.0 per cent. saponin to benzine prevents auto-ignition. C.

**Proteins and Synthetic Detergents: Complex Formation.** See Section 9.

## 8—BUILDING AND ENGINEERING

### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Worn Machine Parts: Repair.** (1) W. Andrews. (2) W. E. Ballard. (3) A. W. Hothersall. *Engineer*, 1943, 176, 412-414, 423-425. Practical hints are given on the reclamation of worn parts by (1) Welding, to build up fresh, hard surfaces, (2) Metal spraying, and (3) Electro-deposition. C.

**Fibre Cans: Production and Uses.** R. P. Bigger. *Chem. Eng. News*, 1943, 21, 1436-1439. Fibre cans comprising paperboard tubes or bodies to which are applied ends of metal or paper are discussed and the methods of producing spirally-wound, convolutely-wound or laminated, and lap-seam bodies are briefly described. The advantages and disadvantages of each type are pointed out. Methods of making the cans moisture-, grease- and oil-proof are outlined. Uses of fibre cans are discussed. C.

## (C)—STEAM RAISING AND POWER SUPPLY

**Automatic Control Circuit: Theory.** P. R. Ewald. *Instruments*, 1943, 16, 474-476, 506. A theory of an ideal automatic control circuit, particularly as applied to chemical processes, is developed and the resemblance of such a circuit to a forced mechanical oscillating system is demonstrated. An arrangement for the control of temperature in an installation for raising to a constant temperature a flow of water passing through a heat exchanger is studied. C.

**Electronic Tubes: Industrial Applications.** *Machinist*, 1943, 87, 94-96. The use of electronic tubes for power rectification, amplification, high-frequency generation, control purposes, and the transformation of light into current and current into light is explained and various industrial applications are discussed. C.

**Fuel Efficiency.** Ministry of Fuel and Power: Fuel Efficiency Committee. *Fuel Efficiency Bull.*, Nos. 17-24, 1943. These bulletins deal with the insulation of furnaces, the sensible use of latent heat, cooling firebricks in industrial furnaces and boilers, the construction of a factory heat balance, utilisation of steam, heavy-oil engines, and the industrial use of liquid fuel. The Ministry has also issued an Industrial Bulletin dealing with economy measures to be observed in the use of lubricating and industrial oils. W.

## (D)—POWER TRANSMISSION

**Driving Belts: Selection and Efficiency.** C. H. S. Tupholme. *Silk & Rayon*, 1943, 17, 694-695. The writer discusses the factors involved in the selection of driving belts and increasing their efficiency. The use of a special pulley fitted with an adjustable weight to increase the arc of contact of a belt is advocated. C.

**Oil: Flow through Engine Bearings; Anomalous Viscosity.** S. M. Neale. *Phil. Mag.*, 1943, [vii], 34, 577-588. Recent data on oil flow through engine bearings are examined and it is shown that the usual assumption of proportionality between shearing stress and velocity gradient is incapable of explaining the data. It is suggested that at high rates of shear lubricating oils undergo molecular orientation, causing a large fall in viscosity, and that the accepted theories of fluid lubrication are inadequate. C.

**V-Belt Speed-change Gear.** Newey Engineering Co. Ltd. *Engineering*, 1943, 156, 426. Illustrations are given of a V-belt speed-change unit that will transmit up to 2 h.p. and allows six changes, over the range 500 to 2,000 r.p.m. when the driving shaft is run at 2,000 r.p.m. The changes are effected by guiding an endless V-belt through diagonal passages in the walls of the grooved pulleys. The guides are applied sideways to the belt between the pulleys and consist of rollers carried on a saddle that slides on diagonal bars attached to the main frame and is traversed by means of a roller chain which is advanced by sprockets worked by a crank handle. C.

## (F)—LIGHTING

**Light Sources: Colour Temperatures.** C. E. Weitz. *Rayon Textile Monthly*, 1943, 24, 501-503. The writer explains the "colour temperature" scale in degrees Kelvin and its application in lighting questions. Direct noon solar radiation is equivalent to about 5250° K., the white fluorescent lamp to 3500° K., the blue-bulb daylight lamp to about 3700° K., and the tungsten filament lamp ranges from 2400 to 3100° K. C.

## (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Hygrometers: Recent Developments.** J. H. Awbery. *J. Sci. Instruments*, 1943, 20, 153-154. Notes are given on some recently-developed forms of hygrometers. C.

**Textile Mills: Air Conditioning.** A. H. Milnes. *Textile Manufacturer*, 1943, 69, 439-440. The importance of air conditioning in textile mills for the efficiency of processing of the material and the health and comfort of the workers is pointed out, and the characteristic features and relative merits of central station plants, ceiling stations, and systems employing dust extracting plant in combination with local humidifiers are considered. Types of local humidifier units and dust and waste collecting and removing devices are discussed. C.

**Humidity Control Devices.** K. Schwertassek. *Kleppzig's Textil-Z.*, 1942, 45, 464-470 (through *Chem. Zentr.*, 1942, ii, 1532 and *Chem. Abstr.*, 1943, 37, 52857). Several designs are described of an automatic apparatus that adjusts the relative humidity to 65 per cent. C.

## (H)—WATER PURIFICATION

**Algae: Control in Water Supplies.** W. D. Monie. *Water Wks. Engng.*, 1942, 95, 512 (through *Water Pollution Res. Summ. Current Lit.*, 1942, 15, 327). A method of determining the dosage of copper sulphate needed for the control of algae in water depends on the fact that the addition of copper sulphate causes the water to become increasingly alkaline until a maximum is reached at the dosage required for the control of the type of alga present in the water. Details of the test procedure are given, and amounts of copper sulphate required for the control of various algae are indicated. The method of applying copper sulphate is described and results obtained with the treatment are reported. C.

**Water: Treatment; Recent Developments.** E. I. Akeroyd. *J. Inst. Brewing*, 1943, 49, 238-244. Advantages and disadvantages of the ordinary lime or lime-soda softening process and base-exchange softening processes are discussed and a general account is given of the "Spiractor" improved lime treatment process and of improved base-exchange processes, such as the bicarbonate control process, the Zeo-Karb hydrogen ion starvation process, and the "Deminrolit" process. Analyses of water before and after such treatments are given. It is possible to remove 95 per cent. of the total solids in an average water. C.

## (I)—WASTE DISPOSAL

**Old Jute Bags: Utilisation.** Rinoldi. *Laniera*, 1941, 55, 183-184 (through *Chem. Zentr.*, 1942, 1, 2948 and *Chem. Abs.*, 1943, 37, 3614). Methods are described of purifying and disintegrating old jute bags, the fibres of which are re-woven, either alone or admixed with wool, into fabrics resembling wool. The sorted bags are treated with aqueous sodium carbonate or preferably with sodium hydroxide, to remove tannin-like compounds. The fabric is then kept for 24-48 hr. in a bath containing 0.2 g. olein, 0.1 g. potassium nitrate, 0.1 g. magnesium sulphate and 0.1 g. phosphoric acid per l. Owing to spontaneous fermentation the initial temperature of 30° rises to 40-45°, but should not exceed this point. The fabric is then centrifuged, and disintegrated while still wet, but not dried because of the fire hazard. The fibres are boiled for at least 1 hr. in a bath containing 1 per cent. sodium hydroxide and 1 per cent. magnesium chloride. The resultant pliable material is washed with water, bleached with sodium hypochlorite, and again washed at 40° for  $\frac{1}{2}$  hr. in a bath containing 2.5 per cent. soap, 2 per cent. petrolatum, and 0.5 per cent. sodium carbonate, or preferably ammonium hydroxide. After slight centrifuging, so that they retain 33 per cent. moisture, the fibres are ready for weaving. W.

## PATENT

**Lubricating Oil.** Standard Oil Co. U.S.P.2,323,670. A mineral oil is blended with a small amount of tetramethyldiaminodiphenylmethane and sodium lauryl sulphate. C.

## 9—PURE SCIENCE

**Polyamides: Viscosity and Molecular Weight.** K. Hosino. *J. Chem. Soc. Japan*, 1941, 62, 602-608 (through *Chem. Abstr.*, 1943, 37, 4698<sup>9</sup>). By determining the depression of the freezing point of polyhexamethylenedipamide, the average molecular weight  $M_n$  was calculated. Then, according to Flory's theory,  $M_w = 2M_n - 131$ , where  $M_w$  = the theoretical molecular weight, and  $p = 1 - 113/(M_n - 18)$ , where  $p$  = the degree of reaction. When the viscosity,  $\eta$ , was plotted against  $M_w$ , the relationship between the two was almost linear within the range of  $M_w$  of 1000 and 7000. The relationship can be expressed by

$$[\eta]_{20} = 5.9 \times 10^{-5} \times M_w + 0.09, \quad [\eta]_{25} = 5.4 \times 10^{-5} \times M_w + 0.085,$$

$$[\eta]_{30} = 5.1 \times 10^{-5} \times M_w + 0.08.$$

The same relationship can be independently deduced from Eisenschitz, Kuhn and Guth's equation of viscosity of chain molecules when transformed into the form of  $\eta = \phi / 1600 \times (l/d)^2 + 2.5\phi / 100$ , where  $\phi$  = specific volume of the solute,  $l$  = molecular length and  $d$  = molecular width. Considering that the condensation between hexamethylenediamine and adipic acid is a bimolecular reaction  $\text{NH}_2 + \text{CO}_2\text{H} \rightleftharpoons \text{CONH} + \text{H}_2\text{O}$ , where  $\text{NH}_2$  and  $\text{CO}_2\text{H}$  remain equal in number from the beginning to the end and the reaction velocity of one radical is independent of the degree of condensation of the molecule to which it is linked, the equilibrium constant  $K$  can be readily calculated from

$$K = [\text{CONH}][\text{H}_2\text{O}] / [\text{CO}_2\text{H}][\text{NH}_2] = p q_w / (1-p)^2$$

(for 1 mol. of  $\text{NH}_2$  and of  $\text{CO}_2\text{H}$ ), where  $p$  = the degree of reaction and  $n_w =$

molecules of water. The  $K$  of a polyamide was found to be about 100 times as large as the  $K$  of a polyester; hence the polyamide is about 10 times more condensed than the polyester. The reaction velocity for 1 molecule can be expressed, putting  $\bar{K} = k/k^1$ , by  $dp/dt = k[(1-p)^2 - n_w \rho/K]$ , and in more general cases by  $dP_n/dt = 1/(1-\rho)^2 \times dp/dt$  (where

$$P_n = 1/(1-\rho) = k[1 - n_w(P_n^2 - P_n)/K]. \quad C.$$

**Polymers: Viscosity-Concentration Relation.** H. L. Bredée and J. de Booy. *Kolloid Z.*, 1942, 99, 171-189 (through *Chem. Abstr.*, 1943, 37, 4289<sup>9</sup>). The viscosity-concentration formula of Bredée and de Booy contains two viscometric constants: the "voluminosity" at infinite dilution,  $V_0$  (ratio of the hydrodynamic volume of the particles, determined from the Einstein equation, to the volume of the particles in the dry state), and the extension factor  $a$ . The value of  $V_0$  is related to the hydrodynamic form and size of the dispersed particles in dilute solution. The factor  $a$  is a measure of the relative magnitude of the increase in viscosity in concentrated solution. Because  $a$  depends on a number of variables, the name "extension factor" is abandoned. Factors worthy of note in connection with the increase in viscosity with increasing concentration are indicated. The general characteristics of various experimental curves for  $V_0$  against  $a$  are given. Special weight is placed on the effect of the intermolecular forces of polar nature. For round compact particles the viscosity increase with increasing concentration is relatively great (very small value of  $a$ ). For homologous series of chain polymers of various kinds an increase in the number of members per chain generally causes the viscosity increase in concentrated solution to become relatively smaller (increasing  $a$  with increasing  $V_0$ ). With polymers of high molecular weight having markedly developed polar groups the increase in viscosity in concentrated solutions is relatively great (at low levels  $a$  remains practically constant as  $V_0$  increases; e.g. cellulose and its derivatives). Polymers of high molecular weight with non-polar particles show a relatively small viscosity increase (higher and continuously increasing value of  $a$  for increasing  $V_0$ ; e.g. polystyrene). The results of measurements on different kinds of rubber are difficult to fit into this scheme. The Bredée-de Booy formula also gives the relation between  $\eta_r$  and  $c_v$  for the various solutions investigated. The formulae of Erbring and Takei and Eilers are critically discussed. It is shown that the formula of Eilers is generally valid for compact round particles, but is unsuitable for long-chain polymers. The formula of Takei and Erbring is applicable to most series of concentrations.

C.

**Adsorbed Dyes: Chemiluminescence.** H. Kautsky and G. O. Müller. *Naturwissenschaften*, 1942, 30, 315 (through *Chem. Abstr.*, 1943, 37, 4305<sup>2</sup>). Chemiluminescence (produced by ozone) and fluorescence (ultra-violet light) of a series of dye adsorbates on silica gel or alumina gel emitted light of essentially the same colour for each dye. Colours ranged from orange red to green. The intensity of chemiluminescence was strongest in the red region.

C.

**Colour-temperature Scale: Establishment and Maintenance.** W. E. Forsythe and E. Q. Adams. *J. Sci. Labs. Denison Univ.*, 1943, 38, 1-31 (through *Chem. Abstr.*, 1943, 37, 4604<sup>8</sup>). Measuring temperatures by matching emitted light from a black body, the standard radiator, with that of the radiator concerned is a tedious and delicate operation; tungsten lamps have therefore been substituted for the black body and a colour-temperature scale has been established with them. A discussion of the laws of radiation, the theory of the construction and operation of a black body, its importance, uses, etc., is followed by descriptions of secondary standards of brightness made from tungsten lamps, their calibration and use. Colour matching and spectral distribution, colour filters and data concerning different types of lamps for general lighting, street and flood lighting, airport and spot lighting, photographic and projection purposes, photo-enlarging, photo-cell exciters and miniature lamps are presented in tabular form.

C.

**Sulphur in Organic Compounds: Determination by Hydrogenation.** W. Theilacker and W. Schmid. *Angew. Chem.*, 1940, 53, 255-256 (through *Brit. Chem. Abs.*, 1943, AII, 247). The ter Meulen method is improved by using platinumed silica wool with a modified absorption train. A silica reaction tube is necessary only for cyclic sulphur compounds, e.g. thianthren, where bright red heat is needed.

W.



**Keratins: Dispersion and Degradation by Sodium Sulphide.** C. B. Jones and D. K. Mecham. *Archives of Biochemistry*, 1943, 2, 209-223. The effects were studied of temperature, time, sodium sulphide concentration, and ratio of keratin to sodium sulphide upon the extent of dispersion of feather keratin in sodium sulphide solutions and upon the yield of material obtained by acidification of such dispersions. Digestion with 0.1M-sodium sulphide (100 ml. of solution per 7.5 g. of keratin) for about 2 hr. at 30° C. yielded maximal dispersion of feather keratin with minimal degradation of the dispersed protein. The latter was recovered nearly quantitatively by acidification of the dispersion to pH 4.2. Feather keratin is more readily dispersed and less stable in sodium sulphide solutions than are the keratins of hoof, hog hair and wool. W.

**Cotton Leaves: Hydration.** E. Phillis and T. G. Mason. *Ann. Botany*, 1943, [New Series], 7, 147-156. An investigation is described of the effects of partial defoliation upon the remaining leaves of a plant supplied with a full nutrient solution. Pruning caused increases in the water, dry weight and protein contents, but only small changes in the depression of the freezing point and conductivity of the sap. In a second experiment, plants grown in a full nutrient solution were partially defoliated and transferred to calcium chloride solutions and subsequent changes in the remaining leaves noted. Under these conditions, the uptake of water by the leaves was proportional to the increase in calcium chloride content. The behaviour of leaves on pruned plants supplied with a full nutrient solution is similar to that of discs floated on a full nutrient solution. Leaves on a pruned plant supplied with calcium chloride solution behave like discs floated on such solutions. It is not certain whether the total amount of salt or its concentration in the sap is the more important factor controlling hydration. C.

**Cotton Leaves: Hydration.** T. G. Mason and E. Phillis. *Ann. Botany*, 1943, [New Series], 7, 157-169. In an experiment in which cotton plants were grown in sand supplied with nutrient solution which was varied in composition and in concentration, water in the leaf was significantly correlated with both dry weight and protein, which are used as indicators of anhydrous protoplasm. When this "Bulk Factor" was removed by expressing water in terms of dry weight and/or protein, hydration was significantly and positively correlated with sap conductivity. The results are fully in accord with a salt hypothesis of foliar hydration. No evidence of a specific effect of any single element on hydration was detected. In a second experiment in which the concentration of the nutrient solution was varied, hydration and sap conductivity were again strongly correlated. Old leaves were found to have higher conductivities and higher hydration than young leaves. It was also observed that conductivity was more strongly correlated with hydration than was freezing-point depression of the expressed sap. The correlation between freezing-point depression and hydration was appreciably increased when the freezing-point depression was corrected for the concentration of sugar in the sap. In a third experiment in which the nitrogen supply varied over a wide range, sap conductivity and hydration were negatively correlated on the dry-weight basis and positively correlated on the protein basis. The causes of this difference are discussed. When the data for the three experiments are combined the correlation between hydration in terms of dry weight and sap conductivity is positive and surprisingly high. Over the wide range of nutrient supply covered by these three experiments, it would seem that hydration is chiefly determined by the level of salt concentration. C.

**Cotton Lint Primordial Cells: Nuclear Changes in —.** *Sci. and Cult.*, 1942, 7, 512-513 (through *Plant Breed. Abstr.*, 1943, 13, 290). Nuclear fusions have been observed in the lint primordial cells of *Gossypium arboreum* var. *typicum*. C.

**Cotton Plants: Treatment with Colchicine.** K. Yamashita. *Japanese J. Genetics*, 1940, 16, 267-270 (through *Plant Breed. Abstr.*, 1943, 13, 346). Polyploid cotton plants ( $2n=104$ ) have been obtained from a strain of Sea Island cotton ( $2n=52$ ) by treatment with colchicine. Although a few well-developed pollen grains were observed in the polyploids, this was exceptional, the pollen being usually sterile and the anther dehiscence feeble. C.

**Amylase: Activity.** A. Janke. *Biochem. Z.*, 1940, 304, 194-200 (through *Brit. Chem. Physiol. Abstr.*, 1943, A III, 683). Data for the liquefaction of starch paste by malt amylase or the hydrolysis of dephosphorylated starch by



pure  $\beta$ -amylase confirm Olsson's finding that the hydrolysis is a unimolecular reaction. This implies the possibility of one substance in the reaction system either alone reacting or being solely responsible for the measured velocity of reaction. Assuming the latter not to hold, it follows that  $\beta$ -amylase changes the reaction velocity so that it corresponds with a negative autocatalysis by a product of the reaction. The action of  $\beta$ -amylase is small at high concentrations of substrate, i.e., when the substrate concentration is constant, and the reaction may be considered as unimolecular with positive autocatalysis by the reaction product. Hydrolysis by various  $\beta$ -amylase-containing bacterial and mould preparations is generally complicated by what appears to be a simultaneous attack by the enzyme on several parts of the starch molecule. C.

**Enzymes: Constitution and Action.** J. H. Quastel. *Endeavour*, 1943, 2, 85-92. A review of the results of recent investigations of the constitution and mode of action of enzymes, under the headings: the constitution of enzymes, reversibility of enzyme action, specificity of enzyme action, combination of enzyme with substrate, attachment-groupings in the substrate, receptor-groupings in the enzyme, prosthetic groups and co-enzymes, and cell metabolism. C.

**Malt Amylases: Stability and Separation.** E. Kneen, R. M. Sandstedt and C. M. Hollenbeck. *Cereal Chemistry*, 1943, 20, 399-423. The maximum precipitation of the  $\beta$ -amylases of wheat and barley malts and the  $\alpha$ -amylase of wheat malt from aqueous solutions occurs in the range of 25 per cent. to 35 per cent. ammonium sulphate concentration. Maximum precipitation of barley-malt  $\alpha$ -amylase is in the 15 per cent. to 25 per cent. range of salt concentration. With alcohol, the maximum precipitation of the  $\beta$ -amylases of wheat and barley malts occurs in the range 56 per cent. to 68 per cent. alcohol concentration, that of wheat-malt  $\alpha$ -amylase in the range 50 per cent. to 56 per cent., and that of barley-malt  $\alpha$ -amylase in the range 44 per cent. to 50 per cent. alcohol concentration. Because of overlapping solubilities, no clear-cut separation of the two amylase components could be effected by precipitation techniques. In differential inactivation studies at 50° to 70° C. and pH 4.0 to 7.0, temperature was found to be the more significant factor with  $\beta$ -amylase, and H-ion concentration with  $\alpha$ -amylase. The presence of Ca ions has a stabilising action on  $\alpha$ -amylase and the opposite action on  $\beta$ -amylase. The stability of the amylases decreases with increasing dilution of the extract. Barley-malt  $\alpha$ -amylase is more stable to heat than wheat-malt  $\alpha$ -amylase, but  $\beta$ -amylase from wheat-malt is more stable than that from barley-malt. Practical methods for the preparation of  $\alpha$ -amylase free from  $\beta$ -amylase and of  $\beta$ -amylase free from  $\alpha$ -amylase are described, and the use of "pure"  $\beta$ -amylase preparations in the preparation of a substrate for the determination of  $\alpha$ -amylase activity is described. C.

**Boric Acid: Determination.** E. G. Beckett and M. F. H. Webster. *Analyst*, 1943, 68, 306. 4:4'-Diamino-1:1'-dianthraquinonylamine, obtained by reducing 4:4'-dinitro-1:1'-anthraquinonylamine with sodium sulphide, dissolves in sulphuric acid to form a blue solution changing to indefinite orange at 150° C. In the presence of boric acid the colour change at 150° C. is to dull greenish-olive, with maximum optical density at about 6200 Å. At this point (which is readily observed with the Hilger Visual Spectrophotometer) the change in optical density is proportional to the quantity of boric acid, provided that this does not exceed 10 per cent. of the weight of the reagent. Details are given of a procedure for the determination of boric acid in organic substances based on this reaction. The substance is ignited with sodium carbonate until the residue is white, and the residue is dissolved in sulphuric acid and the solution treated with the anthraquinonylamine reagent. C.

**Plasticisers: Solubility Determination.** R. N. Haward. *Analyst*, 1943, 68, 303-305. For determining the solubility of a plasticiser in water, a Petri dish containing sufficient water to give a shallow layer with a large surface is placed on a dull black material and illuminated from above and behind by means of an electric lamp, and the plasticiser, or its solution in light petroleum (b.p. 40-60° C.), is dropped on to the water surface from a pipette or burette until a stable scum of oily drops is obtained. The solubility is then calculated from the quantity of plasticiser solution added to the known volume of water. Results obtained for various plasticisers by this method and by saponification

methods are compared. In general, the results of scum titrations agree well with those of saponification methods but with ethyl phthalyl ethyl glycolate the agreement is poor. C.

**1:3-Polysaccharides: Regulated Degradation.** V. C. Barry. *Nature*, 1943, 152, 537-538. When 1:4-polysaccharides, such as starch or cellulose, are treated with periodic acid solution, the carbon chain in each sugar unit is ruptured between carbon atoms 2 and 3, the  $-\text{CHOH}$  groups at these positions being oxidised to  $-\text{CHO}$ . Acid hydrolysis of these oxidised polysaccharides yields solutions containing glyoxal and erythrose. Aqueous solutions of periodic acid-oxidised starch or cellulose yield, when treated with phenylhydrazine acetate, a yellow amorphous precipitate. When the mixture is heated on the water bath, glyoxalosazone is rapidly formed in crystalline condition. The glycosidic linkage, which is fairly resistant to acid hydrolysis, is thus readily opened by the phenylhydrazine reagent under mild conditions. This reaction may be used to bring about a regulated degradation of 1:3-polysaccharides such as laminarin and the glucan of yeast membrane. Periodic acid oxidation of these polysaccharides affects only the non-reducing terminal sugar unit, by eliminating carbon atom 3 and oxidising the  $-\text{CHOH}$  groups at positions 2 and 4 to  $-\text{CHO}$ . Treatment of the oxidised polysaccharide with phenylhydrazine acetate brings about a rapid separation of glyoxalosazone, and the polysaccharide, the chain-length of which is now shorter by one glucose unit, may be readily recovered. The new terminal non-reducing unit may again be oxidised by periodic acid and the process repeated. In this way, the sugar units may be eliminated one by one from the non-reducing end of the polysaccharide chain. The reaction should also prove of value in detecting linkages other than those of the 1:3 variety in polysaccharides where the 1:3 linkage predominates. Where, for example, a 1:4 linkage is present, oxidation and subsequent treatment with the phenylhydrazine reagent should bring about a fragmentation of the polysaccharide chain with the production of oligosaccharides of shorter chain-length. C.

**Nitronaphthylamines: Structure and Colour.** H. H. Hodgson and H. S. Turner. *J. Soc. Dyers & Col.*, 1943, 59, 218-220. The mononitronaphthylamines can each resonate into one of the seven quinonoid structures, and since of the 13 known compounds all are red, except the 2-, 3- and 4-nitro-1-naphthylamines which are yellow, it is suggested that the 10 red isomerides have a single bond between the central carbon atoms, whereas the three yellow isomerides have a double bond. In harmony with this view, the red  $\beta$ -naphthaquinone should also possess a central single bond and not the usually accepted Erlenmeyer formulation. The structures of the dinitronaphthylamines are discussed from this standpoint. The colour effects produced by halogen substituents in the mononitronaphthylamines are also discussed. C.

**Polyvinyl Alcohol: End Group Structure.** C. S. Marvel and G. E. Inskeep. *J. Amer. Chem. Soc.*, 1943, 65, 1710-1714. Viscosity measurements have shown that, in general, alcoholysis of a polyvinyl acetate sample with methyl alcohol and sulphuric acid results in an alcohol with, apparently a longer chain than was present in the ester from which it was formed. Saponification of polyvinyl acetate with sodium methoxide usually produces a polyvinyl alcohol of the same or greater chain length (degree of polymerisation) than the polyester. Heating a sample of polyvinyl alcohol in water with a trace of acid usually causes a reduction in chain length. A solid sample of polyvinyl alcohol containing a trace of acid is likely to increase in apparent chain length on standing. Reactylation of such a sample usually results in the formation of an ester of shorter chain length. These changes in apparent chain length are very irregular and unpredictable in amount. A possible explanation of this behaviour is that polyvinyl alcohol may have one terminal aldehyde group which, under acid conditions, can undergo acetal formation with the hydroxyl groups of neighbouring molecules. Under alkaline conditions an aldol or reverse aldol reaction may occur to cause changes in molecular size. The product obtained by suspending polyvinyl alcohol in alcohol acidified with an excess of 2:4-dinitrophenylhydrazine gives with alkali the typical violet colour characteristic of 2:4-dinitrophenylhydrazones. Definite similarities are observed between the absorption spectra of this 2:4-dinitrophenylhydrazone derivative of polyvinyl alcohol, and the corresponding derivatives of *n*-butyraldehyde and crotonaldehyde. C.

**Soap: Solid Phases.** R. H. Ferguson, F. B. Rosevear and R. C. Stillman. *Ind. Eng. Chem.*, 1943, 35, 1005-1012. Evidence is presented for the existence of four separate crystalline phases ( $\alpha$ ,  $\beta$ ,  $\omega$  and  $\delta$ ) in sodium soaps, and the identification and estimation of the approximate proportions of these phases by means of X-ray diffraction patterns is discussed. The characteristics of each phase are described. The significance of phase changes for soap technology is illustrated. The  $\beta$ ,  $\delta$  and  $\omega$  phases are important in the understanding of milling, extrusion and other processes. The  $\alpha$  phase exists under so limited a range of conditions as not to come within the realm of most commercial soaps. C.

**Wurster Dye Free Radicals: Polymerization.** L. Michaelis and S. Granick. *J. Amer. Chem. Soc.*, 1943, 65, 1747-1755. Wurster dyes, which are free semiquinone radicals when in dilute solution, polymerize at low temperature, or at higher concentration, and especially in the crystalline state in which they can be obtained as bromides or perchlorates. Only the radical derived from tetramethyl-*p*-phenylenediamine (Wurster blue) does not polymerize and remains a very stable free radical even in the solid state. In solution, equilibrium is established between the monomeric and polymeric forms. In the solid state, however, there is an all-or-none law: the crystals are completely polymerized and diamagnetic with the susceptibility expected for a regular organic molecule, or they are entirely in the free radical state and paramagnetic with the susceptibility expected for an organic molecule with an odd electron. The latter case is true only for Wurster blue. The polymerization may consist either in forming dimers or higher polymers. Polymerization can occur when the diamine from which the compound is derived has at least one unsubstituted hydrogen atom at each of its two amino groups. The dimerized (or polymerized) molecule is a structure resonating between a compound of one molecule of the diamine and one molecule of the (doubly positively charged) di-iminium ion. The resonance consists in an alternately occurring exchange of the quinonoid and benzenoid structures of the two rings, which lie in the same plane. The quinone-benzene resonance is synchronized with an exchange of an electron pair between the two adjacent nitrogen atoms. The four atoms attached to these two nitrogen atoms lie in a plane perpendicular to that of the benzene rings. If these four atoms are not all hydrogen atoms, but in part methyl groups, steric hindrance weakens this bond and makes the compound unstable. If all four hydrogens are substituted by methyl groups, no bond can be established and the compound remains a monomeric free radical even in the solid state. C.

**Liquids: Film Formation.** C. W. Foulk and J. E. Barkley. *Ind. Eng. Chem.*, 1943, 35, 1013-1016. Water, benzene, nitrobenzene, ether, acetone, *n*-heptane, and methanol were tested for film-forming properties by ring-lifting, two-bubble and shaking methods, details of which are given. When the liquids were highly purified they did not form films. The purification of the organic liquids consisted largely in the drastic reduction of the amount of water in them. Additions of a few hundredths of one per cent. of water to the purified liquids restored their film-forming properties. C.

**Liquids; Measurement of Tension in —.** R. S. Vincent and G. H. Simmonds. *Proc. Phys. Soc.*, 1943, 55, 376-382. The Berthelot method of measuring hydrostatic tension in liquids yields values of the order of 150 atmospheres. A modified Berthelot method is described in which sealing is effected by freezing and the pressure at the moment of sealing is known. Measurements on mineral oil by this modified method have given values not exceeding 25 atmospheres, in agreement with values obtained by the viscosity-tonometer method. The conclusion is reached that falsely high values can be obtained by the ordinary Berthelot method due to the high pressure liable to exist in the final bubble before the tube becomes completely filled by the expanding liquid. C.

**Cellulose and Sugar: Heats of Solution and Wetting; Influence of Superfine Grinding.** J. Gundermann. *Kolloid Z.*, 1942, 99, 142-147 (through *Sci. Abstr.*, 1943, A 46, 163). X-Ray interference disappears with superfine grinding. By determining the heat of solution of sugar after grinding for different periods of time, it was shown that the difference in total energy content between unground and superfinely ground sugar corresponds to the heat of solution. The latter therefore indicates the efficiency of the grinding mill. With cellulose the destruc-

tion of the lattice structure is indicated by the heat of wetting. For coke also, the latter is an indication of the fineness of grinding. C.

**High Polymers: Molecular Weight Determinations.** M. L. Huggins. *Ind. Eng. Chem.*, 1943, 35, 980-986. The equations generally used for the calculation of molecular weights from osmotic pressure or cryoscopic data are valid only at infinite dilution; their use with data obtained at finite concentrations (without extrapolation to infinite dilution) leads to very large errors, if the solute molecules are large. In extrapolating osmotic or cryoscopic data to infinite dilution, graphs of  $\pi/c$  (or  $\rho/c$ ) against  $c$  are useful and show a rectilinear relationship. The use of Staudinger's rule to obtain molecular weights of high polymers is, theoretically and experimentally, unjustifiable, for most polymer-solvent systems at least. The more general relationship  $[\eta] \equiv (\eta_{sp}/c)_{c=0} = KM^v$  where  $K$  and  $v$  are constants to be determined empirically is more satisfactory. At present, empirical  $[\eta]/M$  curves must be determined, on polymer samples that are molecularly homogeneous, before true molecular weights can be deduced from viscosity data. Theoretically and experimentally it is preferable to relate the molecular weight to  $[\eta]$ , rather than to  $\eta_{sp}/c$  or  $\ln(\eta/\eta_0)/c$  at some finite concentration. Extrapolation to infinite dilution is readily accomplished by means of graphs of  $\eta_{sp}/c$  against  $\eta_{sp}$ . The ratio of the slope of the straight line obtained to its intercept depends on the type of solute and solvent and on the temperature but not on the molecular weight of the solute. Osmotic pressure and cryoscopic measurements yield ordinary number-average molecular weights. Viscosity data, properly interpreted yield another sort of average in which the heavier molecules are relatively more important. The exact nature of this average depends on the  $[\eta]/M$  curve (or on the value of  $v$  in the equation  $[\eta] = KM^v$ ). If, for a given type of polymer, the constant ( $\mu_1$ ) determining the dependence of the osmotic pressure (in a suitable solvent) on concentration, the constant ( $K'$ ) determining the dependence of the viscosity (in a suitable solvent) on concentration, and the constants ( $K$  and  $v$ ) determining the dependence of the intrinsic viscosity on molecular weight (or an empirical curve showing this dependence) are known, a single osmotic pressure measurement and a single viscosity measurement on a given sample suffice to give the number-average molecular weight and a viscosity-average molecular weight (the meaning of which depends on the magnitude of  $v$ ). These two together give a better characterisation of the polymer sample than either alone. C.

**Polyvinyl Chloride: Effect of Softeners.** K. Leilich. *Kolloid Z.*, 1942, 99, 107-113 (through *Sci. Abstr.*, 1943, A 46, 170). Relations between the viscosities of the components at constant and varying temperatures, and between viscosity and electric conductivity, are discussed for mixtures of polyvinyl chloride and softeners. Practical hints are given for preparing the mixtures and for testing the softeners. C.

**Scattered Sunlight: Emission and Reception.** L. Silberstein. *J. Optical Soc. America*, 1943, 33, 526-532. Simplified formulae are deduced for the emission and reception of primary and secondary scattered sunlight, on the assumption of a flat earth or plane-stratified atmosphere. C.

**Ultra-violet Solar Radiation: Intensity.** W. W. Coblentz and R. Stair. *J. Res. Natl. Bur. Stnds.*, 1943, 30, 434-447. A report is given of measurements of ultra-violet solar radiation in Washington, D.C., during the years 1936 to 1942. Marked variations in the spectral quality and total intensity of ultra-violet solar radiation, attributable to variations in atmospheric turbidity, and to a less extent, to well-known cyclonic and seasonal changes in ozone concentrations in the stratosphere, are recorded and discussed. On the clearest days the biologically effective ultra-violet radiation of wave lengths shorter than 3132 Å, incident directly from the sun and the surrounding sky at midday, ranges from about 75  $\mu\text{w}/\text{cm}^2$  in midsummer to about 12  $\mu\text{w}/\text{cm}^2$  in midwinter. C.

**Gels: Orientation.** A. Frey-Wyssling. *Helv. Chim. Acta*, 1943, 26, 833-846 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 226). Simple equations are given connecting the refractive index of a gel with its degree of orientation, this being represented by a single quantity, the scattering angle. The structure of Cellophane is discussed. C.

**Red-Green Discrimination Testing Apparatus.** L. H. Hardy. *J. Optical Soc. America*, 1943, 33, 512-514. A test for red-green discrimination is described that makes use of two series of small-step chroma differences in hues designed

to confuse the observer who makes errors of the typical protanope and of the typical deutanope. The series extend from Munsell N<sub>5</sub>/ in 40 steps of saturation to 6R 5·4/4 for the protanope series, and in 40 steps of saturation to RP 5·0/4 for the deutanope series. The material is in the form of metal chips with the colour baked on an enamel surface. Twenty pairs of chips are mounted juxtaposed on a disk which is covered with a mask having two openings; one at the left and one at the right, each of which exposes one pair of chips at a time. The subject is asked to indicate whether the left chip of a pair or the right chip is the redder. The effect of having two openings in the mask is that 40 judgments are obtained from 20 pairs of chips, and that the right-left position of the members of each pair is taken into account. Illumination is by standard artificial daylight (Macbeth) in the colour temperature range of 6700° K-7500° K. Photographs of the apparatus and details of the method of scoring are given. The advantages of the test are pointed out and results are briefly compared with those obtained in other tests. C.

**Liquid Flow: Graphical Analysis.** K. J. De Juhasz. *Instruments*, 1943, 16, 466-472, 508, 510. The interrelations between liquid level, rate of influx and rate of efflux for a storage vessel are determined by graphical analysis. It is assumed that a constant rate of influx and efflux exists during a small finite time element, whereby the level is changed by a small amount which can be graphically determined. The new level determines a new rate of influx and efflux, which again is assumed to be valid for the next time interval, for which the new change of level is determined. Thus, the entire duration of the phenomenon can be covered in a number of steps. The procedure is applied to nine examples of flow processes of different types. C.

**Turbulent Medium; Equation of Diffusion in —** W. G. L. Sutton. *Proc. Roy. Soc.*, 1943, A 182, 48-75. The two-dimensional form of the equation of diffusion

$$u \frac{\partial \chi}{\partial x} = \frac{\partial}{\partial z} \left\{ A_z \frac{\partial \chi}{\partial z} \right\} \quad (z > 0),$$

under steady mean conditions with mean velocity  $u$  is discussed for the case where  $u$  and  $A_z$  vary as  $z^m$  and  $z^{1-m}$  respectively ( $0 < m < 1$ ). In this equation  $\chi(z, x)$  is the value of the entity, such as vapour concentration or temperature, whose diffusion is considered,  $x$  being measured in the direction of mean flow and  $z$  in the perpendicular direction, and  $A_z$  is a generalized coefficient of diffusion such that the rate per unit length at which  $\chi$  is transferred across the line  $z = \text{constant}$  in the positive direction is  $-A_z(\partial \chi / \partial z)$ . Integrals are constructed which satisfy boundary condition of the types arising in physical problems, and the results are applied to the theory of evaporation into a turbulent atmosphere. C.

**Turbulent Air Stream: Evaporation of Liquids.** F. Pasquill. *Proc. Roy. Soc.*, 1943, A 182, 75-95. Measurements of the evaporation from plane, free-liquid surfaces of relatively small dimensions into a tangential air stream are reported. The importance of the type of boundary layer flow is pointed out and data obtained for rates of evaporation under the influence of a turbulent boundary layer are compared with Sutton's hydrodynamical theory. It is shown that, when developed into a computable form and tested against the results obtained for the evaporation of bromobenzene and against experiments by Elias on the analogous problem of convective heat transfer, the theory predicts the absolute rate of turbulent transfer in a satisfactory manner. An extension of the analysis to the relative rates of evaporation of the various liquids studied and to the results obtained by Wade shows that the theory specifies inadequately the variation of rate of evaporation with type of liquid. In the absence of a precise theoretical argument, an empirical generalization of Sutton's theory is set forth, in which the turbulent interchange coefficient is modified by the molecular diffusion coefficient appropriate to the entity undergoing transfer. The range of physical characteristics covered in the evaporation experiments and in those performed by Wade is sufficient to demonstrate the closer agreement provided by the generalized form of the theory. A more general test, against previous investigations for which the aerodynamic conditions can be estimated with reasonable confidence, shows that the absolute rate of evaporation may be predicted correctly in order of magnitude. In all cases considered the observed rates are in excess of the theoretical values, but it is significant that the discrepancy decreases as the experimental conditions conform more closely to the ideal conditions assumed in the theoretical treatment. C.

**Amylose-Iodine Complex: X-Ray Diffraction.** R. E. Rundle and D. French. *J. Amer. Chem. Soc.*, 1943, 65, 1707-1710. The amylose-iodine complex has a hexagonal unit cell,  $a_0 = 12.97$ ,  $c_0 = 7.91$ ,  $d_{100} = 11.23$  Å. The unit cell confirms a helical structure for the starch-iodine complex, the diameter of the helix being 12.97 Å. and the length of a turn in the helix 7.91 Å. These dimensions are in good agreement with the dimensions of a space-filling model of a helix with six glucose residues per turn. Starch will absorb iodine vapour in quantity when in the "V" configuration but not in the "A" or "B" configurations. The starch-iodine complex can thus be prepared entirely without water or iodide ion if the starch is first put into the "V" configuration by alcohol precipitation. Amylose in the "V" configuration will absorb 26 per cent. of its own weight of iodine. This corresponds to one iodine for six glucose residues, but it is not established that this is the maximum iodine absorption. C.

**Carbon Black: Density.** R. P. Rossman and W. R. Smith. *Ind. Eng. Chem.*, 1943, 35, 972-976. A method and apparatus for the determination of the density of carbon black by immersion in helium are described in detail and results obtained for three commercial blacks are compared with results obtained by immersion in water and with the densities calculated from X-ray diffraction data. The values calculated from X-ray data are greater than the immersion values. The results confirm the view that the working particle of carbon black consists of a cluster of parallel layer groups. By comparing the density of the parallel layer groups as determined from X-ray data with the helium immersion density of the cluster, the porosity or free space within the particle can be evaluated. In the case of acetylene black, this free space is accessible to helium and a pronounced drift in the helium density value is observed. In the case of channel blacks, the separation between parallel layer groups is too small to permit penetration by helium. C.

**Cellulose: Particle Size Distribution.** R. Hosemann. *Z. Elektrochemie*, 1940, 46, 535-550 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 226). A method has been developed for determining the quantitative particle-size distribution from the intensity distribution in the central spot obtained in the X-ray diagram, using a monochromatic X-ray beam. The method assumes that the particles behave as rotation ellipsoids and is independent of whether the particles are crystallites, distorted crystallites, micelles, or amorphous conglomerates. Crystallites of  $C_{31}H_{44}$  are very flat discs mainly 400 Å. high and of considerable breadth which apparently attains macroscopic dimensions. In cellulose fibres the upper limit of micelle thickness is 400 Å., the most frequent thickness being that of a single molecular chain; purified ramie has thinner micelles than the unpurified material. The length distribution maximum occurs at 3000 and 200 Å. for ramie and cellulose triacetate, respectively. The latter value is not in accord with that deduced from viscosity data. The results are discussed in relation to the structure of cellulose. C.

**Long-chain Molecular Network: Elasticity.** L. R. G. Treloar. *Trans. Faraday Soc.*, 1943, 39, 241-246. Wall's treatment of the elasticity of a molecular network is extended to cover the general homogeneous type of deformation of rubber. An equation is derived from the work of deformation in terms of the three principal strains, from which certain general stress-strain relations are deduced. These relations involve only one physical constant of the material. The use of the formulae is illustrated by their application to a number of simple cases. It is shown that the effective rigidity in respect of a shear in a plane at right angles to a previous elongation is inversely proportional to the elongation. C.

**Amylose: Enzymic Cleavage.** K. Myrbäck and W. Thorsell. *Svensk Kem. Tid.*, 1942, 54, 50-60 (through *Chem. Zentr.*, 1942, ii, 1465 and *Chem. Abstr.*, 1943, 37, 5884<sup>b</sup>). The cleavage of amylose (prepared according to Meyer) with dextrinogen amylase (according to Ohlsson) proceeds rapidly up to formation of 44 per cent. "maltose," then more slowly; a sharp bend in the cleavage curve, accordingly, lies at 44 per cent. for amylose, whereas it occurs at 27 per cent. for starch and at 12 per cent. for  $\beta$ -dextrin. The dextrination, therefore, in the three cases results in products with different average molecular weights; the length of the chain of the mixture of  $\alpha$ -dextrins formed amounts to 5, 8 or 17 glucose residues. In agreement with earlier results it was found that from  $\beta$ -dextrin, i.e. from the branched "nucleus" of amylopectin, primary dextrins with relatively high molecular weights (which contain "anomalies")\* are formed, whilst from

amylose, as well as from the normal side chains of amylopectins, are formed  $\alpha$ -dextrins with lower molecular weights. It is concluded that the primary action of the dextrinogen amylase is a dextrination differing in nature from the other activity of the enzyme and that in starch and its components certain glycosidic compounds are much more easily attacked by the dextrinogen amylase than others. C.

**Aspergillus Niger: Effect of Heavy Metal Ions on Growth.** J. Fischer. *Planta*, 1942, 32, 395-413 (through *Chem. Abstr.*, 37, 5445<sup>2</sup>). With *A. niger* in nutrient substrates starch decomposition and amylase content are least at the optimum growth concentrations of the elements Zn, Cu, Fe and Mn. Zn is a nutrient at its optimum concentration and a poison at greater concentrations; it retains this toxicity at optimum concentrations of Fe and Cu. At the Zn-optimum Cu and Fe are detoxified. With regard to mycelial development, the elements are interchangeable at low ranges. The metals have a favourable effect on spore germination and mycelial growth and exert this effect throughout the life of the fungus. C.

**Polarographic Analysis: Theory and Applications.** J. G. N. Gaskin and H. K. Whalley. *Chemistry and Industry*, 1943, 62, 441-445. The theoretical basis of polarographic analysis is explained and practical applications are briefly discussed. C.

**Protein Hydrolysates: Analysis for Dicarboxylic Acids.** K. Bailey, A. C. Chibnall, M. W. Rees and E. F. Williams. *Biochem. J.*, 1943, 37, 360-372. An account is given of investigations of the lime-ethanol method of Foreman for the determination of aspartic and glutamic acids in protein hydrolysates and of various modifications introduced by other workers. During treatment with the lime the cystine present in the hydrolysate undergoes partial dismutation to the sulphinic or sulphonic acids; these are precipitated with the Ca dicarboxylates by the ethanol, together with small amounts of cystine itself, tyrosine, serine and bases. The Ca salts of these cystine dismutation products are very insoluble and interfere with the estimation of aspartic acid as Cu aspartate. To prevent their formation it has been found advantageous to remove all cystine as the cuprous mercaptide of cysteine before the hydrolysate is made alkaline with lime. The solubility of the Ca dicarboxylates under the conditions of the modified Foreman procedure used has been investigated by clarifying the lime-ethanol filtrate, removing the bases, and repeating the lime-ethanol treatment on the final mother liquor. Significant amounts of both aspartic and glutamic acids have been isolated. Based on these findings a new extended procedure has been elaborated which there is reason to believe has given values for the aspartic acid and glutamic acid contents of gliadin, edestin and egg albumin that are accurate to about 2 per cent. The possibility of applying solubility corrections to the dicarboxylic acid results obtained in an analysis covering only one complete lime-ethanol treatment has been investigated. Results for casein and haemoglobin obtained in this way are higher than those hitherto recorded. Reasons are given for the belief that the "hydroxyglutamic acid" fractions obtained by earlier workers are complex mixtures containing aspartic acid and dismutation products of cystine. C.

**Collodion Cotton Solvents.** A. Kraus. *Farben-Ztg.*, 1942, 47, 52 (through *Chem. Zentr.*, 1942, ii, 1293 and *Chem. Abstr.*, 1943, 37, 5861<sup>3</sup>). Results are given of the solvent action on collodion cotton of uni- and bi-valent alcohols mixed with 2 or 1.25 times their weight in halogenated hydrocarbons. C.

**Cotton Cellulose: Effect of Prolonged Acid Treatment.** G. F. Davidson. *J. Textile Inst.*, 1943, 34, T 87-96. C.

**Methylcelluloses: Preparation and Properties.** J. Vacher. *Chim. et Ind.*, 1939, 43, Suppl. to No. 8, 347-354 (through *Chem. Zentr.*, 1941, i, 2470 and *Chem. Abstr.*, 1943, 37, 5588<sup>3</sup>). The production and properties of methylcelluloses are reviewed, and some experiments are reported on the solubility of various methylcelluloses in systematically varied mixtures of methylene chloride and alcohol. The solubility tests indicate a marked lack of uniformity in the products. C.

**Nitrogen Peroxide Oxycellulose: Application in Surgery.** *Chemical Products*, 1943, 6, 76. It is reported from America that pledgets of cellulose, oxidised by



nitrogen peroxide and steeped in thrombin, are being used to stop bleeding in surgical operations. The material dissolves slowly in alkaline fluids such as blood and may therefore be left in the wound. It is sterilized by boiling and stored for use in 70 per cent. alcohol. C.

**Casein: Acetylation with Ketene.** A. Schöberl and F. Krumei. *Beiheft Z. Ver. deut. Chem.*, No. 45, *Die Chemie*, 1942, 55, 63-64 (through *Chem. Abstr.*, 1943, 37, 5513<sup>6</sup>). Ketene has been used to study the relation between activity and chemical constitution. Because the over-all behaviour of proteins is, at least in part, determined by the presence and the number of free functional groups, especially  $\text{NH}_2$ ,  $\text{HO}$ ,  $\text{CO}_2\text{H}$  and  $\text{SH}$  groups, the behaviour of pure proteins with ketene has been studied. So far, only 4.7 per cent. of acetyl has been introduced into casein. Acetylation of casein with ketene is best carried out in alkaline solutions. On the assumption of a molecular weight of 35,000 for casein, an acetylcasein prepared in the pH range 6.6-11.5 contains 12-39 acetyl groups; at pH 11.9, 19 N-Ac groups are present and the free  $\text{NH}_2$  groups have almost disappeared. Acetylcasein also contains O-Ac groups and usually the two types are present in about equal amounts. The O-Ac groups are easily removed, but the N-Ac groups show a very marked stability to hydrolysis. The peptide linkages introduced through the acetylation of  $\text{NH}_2$  groups are more stable to caustic soda than a portion of the native peptide linkages of casein. Model experiments on the hydrolysis of N-acetylglutamic acid, O:N-diacetyltyrosine and acetyllactic acid confirm the increased stability of the acetylcasein. This property of acetylcasein should make it suitable for the study of the preparation of protein fibres. Acetylcasein can be spun into fibres by the usual methods. The acetylcasein with the highest acetyl content requires twice the amount of caustic soda usually employed with casein, probably because of the greatly increased acidic properties; an acetylcasein with a low acetyl content is not soluble in caustic soda but swells to a greater or less extent. C.

**Para-casein: Preparation from Rennet Casein.** A. Schöberl and H. Wolff. *Beiheft Z. Ver. deut. Chem.*, No. 45, *Die Chemie*, 1942, 55, 64 (through *Chem. Abstr.*, 1943, 37, 5513<sup>9</sup>). Para-casein results from casein by the action of rennet and is characterised by a difficultly soluble calcium salt (rennet casein). A practical method for the preparation of para-casein consists of the action of acetic acid on rennet casein; the action can be followed easily by ash determinations. Para-casein is purified by precipitation with acid from neutral or slightly alkaline solution. It is suitable for the preparation of fibres, but they are hard and brittle (cooking test). C.

**Rubber and Other Olefins: Combination with Phenol-Formaldehyde Resins.** J. I. Cunneen, E. H. Farmer and H. P. Koch. *J. Chem. Soc.*, 1943, 472-476. Rubber, isoprenic olefins, and doubtless most olefinic substances combine in virtue of their unsaturation with the condensation products of phenol and formaldehyde to given chroman derivatives. The detailed structure of the combination products, the relation of chroman-formation to the formation of phenol-formaldehyde resins, and the significance of certain ancillary features of the reaction are discussed. C.

**Rubber: Structure.** R. Houwink. *J. Phys. Chem.*, 1943, 47, 436-442. Modern ideas on the structure of raw rubber and of vulcanized rubber are discussed with special reference to the conception of long-chain molecules in loose, irregular coils ("Knäueln"). A measure for the degree of compactness of these tangles in solution is indicated, which is a more general one than that introduced by Staudinger for degree of branching. Emphasis is laid on the opinion that probably already in unvulcanized raw rubber the chains in the tangle are partly cross-linked by bridges. The formation of sulphur bridges during vulcanization is discussed. C.

**Cellulose Acetate Ultrafilters: Preparation and Use.** M. A. Bargues. *Farmac. nueva*, 1942, 7, 82-89 (through *Chem. Zentr.*, 1942, ii, 1211-1212 and *Chem. Abstr.*, 1943, 37, 5635<sup>5</sup>). Ultrafilters can be prepared by dissolving cellulose acetate in a 75 per cent. solution of magnesium perchlorate, coagulating by dilution with water or dilute magnesium perchlorate solution, and washing out the salt. The mechanical strength of filters can be increased by forming them on filter paper, cloth or metal fabrics. A suspension of silicon carbide in aqueous ammonia was separated by decantation, ultrafiltration and fractional centrifugation into fractions of uniform particle size. An ultrafilter was constructed by depositing on filter paper from aqueous suspensions successive layers



of silicon carbide particles of progressively decreasing size. Filters of this type permitted determination of micelle sizes. These were for arsenic sulphide sol, 0.25; ferric hydroxide, 0.05; gold, 0.04; copper cobalt cyanide, 0.25; Prussian blue, 0.15 $\mu$ . The heterogeneous nature of gum arabic and egg albumin was established. For polystyrene (molecular weight 700,000) the rate of filtration is inversely proportional to the viscosity. A solution of cellulose acetate in dioxane did not filter in accordance with this rule, probably because of the shape of the molecule. Thus a fraction of molecular weight 57,000 did not filter through pores of 0.1 $\mu$ , although the calculated molecular diameter is 0.0043 $\mu$ . Filters of silicon carbide are suitable for classifying biological colloids. C.

**Polyamide Plastic Ultracentrifuge Cells.** G. Bergold. *Kolloid Z.*, 1943, 102, 292-293 (through *Chem. Abstr.*, 1943, 37, 5625<sup>9</sup>). Tubes and cells made from three different polyamide condensates withstand fields up to 150,000 g. From the three types a choice can be made for heat-resistance, resistance to organic solvents and strong acids or bases. The tubes and cells are very resistant to change in form in high centrifugal fields. C.

**Contact Angles: Measurement.** E. J. Irons. *Phil. Mag.*, 1943, [vii], 34, 614-624. Cosines of the contact angles made by liquids with solids can be determined by placing a capillary tube of the solid to be studied vertically in a bath of the liquid and finding the pressure required to maintain the liquid meniscus at the lower end of the capillary and then the maximum pressure occurring as a bubble of air is detached. The theory of this method is explained, and the results of observations on the receding angles made by six different liquids on six different metals and by a number of liquids on glass are reported. The results indicate that, to a few parts in a thousand, the cosines of the angles are all unity. C.

**Proteins and Synthetic Detergents: Complex Formation.** F. W. Putnam and H. Neurath. *J. Biol. Chem.*, 1943, 150, 263-264. Experiments with crystalline horse serum albumin and sodium dodecyl sulphate have shown that complex formation between detergents and proteins occurs on both sides of the isoelectric point. On the acid side precipitation of the complex occurs but excess of detergent leads to solution of the precipitate. Denaturation, as revealed by viscosity measurements, occurs in both acid and alkaline regions. Relatively low concentrations of detergents exert a high denaturing action compared to that of urea or guanidine hydrochloride. In electrophoretic and solubility properties, protein regenerated from regions of detergent excess resembles that recovered from the precipitated protein-detergent complex. C.

**Foam: Formation.** G. K. Dyakonov. *J. Tech. Phys. (U.S.S.R.)*, 1942, 12, 302-314 (through *Chem. Abstr.*, 1943, 37, 5299<sup>3</sup>). The theory of similarity is applied to the study of foam formation and an attempt is made to include kinematic and dynamic factors. If  $h(m)$  is the height of the foam column,  $E(m/sec.)$  the linear velocity of the gas phase leaving the surface and  $\tau_g (sec.)$  the stability of the foam, the relation  $h = E\tau_g$  applies. The parameters characterising the dynamic and kinematic conditions are  $\nu$  the kinematic viscosity of the solution,  $\nu$  any arbitrary velocity in the system, and the densities  $\rho_1$  and  $\rho_2$  of the gaseous and of the liquid phase. The parameters characterising the apparatus are:  $d$ , its linear dimensions and  $H$  the height of the solution. By considering the dimensions and introducing the Reynolds number  $Re = \nu d / \nu$  and replacing  $\nu$  by  $E$ , it is deduced that  $h/E\tau_g = C(Re)^m(H/d)^p$ , where  $\tau_g$  is the conventional foam stability, and as criterion for the foam formation  $h/E\tau_g = \tau_g/\tau_c$ . Experiments made to confirm the first of these two relations were so made as to check whether to each group of the values of  $Re$  and  $H/d$  there actually corresponds one value of the foam-formation criterion. The foam was formed by blowing air through water-soap or water-alcohol-soap solutions in a cylinder. The conventional stability  $\tau_c$  was determined from experiments at low  $E$  values, where  $\tau_c$  proved independent of the Reynolds number. It was found that in the equation above  $C=1$ ,  $m=0$  and  $p=0.8$ . Then, at higher gas velocities  $h/E\tau_g$  was investigated first as a function of  $Re$ , then as a function of  $H/d$ ; finally the dependence of  $h = f(E)$  and  $h/E\tau = f'(Re)$  on the viscosity was determined. It was found convenient to make plots of  $(h/E\tau_c)(d/H)^{0.8}$  as a function of  $Re = Ed/\nu$  on a log-log scale. All the results fit perfectly on one curve, composed of two linear parts, a horizontal ( $m=0$ ) for  $Re$  less than 100 and an inclined part, where the stability depends on  $Re$ , for  $Re$  greater than 100. The inclined part is described by the relation given above by assuming  $C=0.044$ .

$Re = 1.2$ ,  $p = 0.8$ . For this range of  $Re$  the foam stability depends on the kinematic conditions, but in both ranges discussed the destruction of the foam takes place on the top, not on the bottom, where the kinematic effects are expected to be strongest. If the Reynolds number is increased further ( $Re = 200-250$ ), the height of the foam column first increases slightly, then falls abruptly. C.

**Native Cellulose: Molecular Weight.** N. Gralén and T. Svedberg. *Nature*, 1943, 152, 625. Measurements have been made of the sedimentation and diffusion velocities of different celluloses in cuprammonium solution and the molecular weights have been calculated from the formula  $M = RTs/D(1 - V\rho)$ , where  $s$  and  $D$  are the sedimentation and diffusion constants and  $V$  is the specific volume of cellulose in cuprammonium solution. The following values have been obtained: unbleached cotton linters  $1.50 \times 10^6$ , raw Georgian cotton  $1.00 \times 10^6$ , nettle fibre cellulose  $1.76 \times 10^6$ , ramie  $1.84 \times 10^6$ , and sulphite wood pulp  $0.46 \times 10^6$ . The results of viscosity measurements on these celluloses do not agree with Staudinger's hypothesis of a linear relation between relative viscosity and molecular weight, but indicate that the molecular weight increases more rapidly than the viscosity. From the sedimentation data it can also be deduced that the longer the molecules are, the more do they tend to become curled. C.

**Starch and Pigment Suspensions: Sedimentation Volumes and Anomalous Flow.** W. Gallay and I. E. Puddington. *Canadian J. Res.*, 1943, 21 B, 172-178. The sedimentation volumes of starch, magnesium oxide, ferric oxide, and talc have been measured in xylene, benzene, chloroform, alcohol, ether and similar liquids. The results are greatly influenced by the presence of small quantities of water which produce increases in sedimentation volumes, especially in non-polar liquids. The increase in sedimentation volume is related to flocculation of the particles, which leads to a branched-chain scaffolding type of structure. Viscosity determinations show that such structures possess rigidity, which is absent in systems showing a small sedimentation volume. The effect of flocculation is particularly large in suspensions of aniso-dimensional particles. C.

**Suspensions: Determination of Particle Size Distribution.** S. Berg. *Ber. deut. keram. Ges.*, 1942, 23, 271-299 (through *Chem. Abstr.*, 1943, 37, 5634<sup>9</sup>). A method is described which makes use of small weights suspended in the suspension. The weights are described, the largest two being elliptical in shape and the smallest spherical. The weights are made of glass and are provided with soft iron disks or spirals, so that they can be sighted at their centres of gravity and actuated by a magnet. A series of weights is used of known density from 1.001 to 1.01, exact adjustment being made by etching in a hydrofluoric acid solution of proper density. In making a measurement, settling of the suspension is allowed to take place, and the equilibrium position of a submerged weight is determined after a known time. By use of Stokes' law this yields the percentage of material with sizes less than a given size. The weights can also be used with suspensions that have been centrifuged under known conditions. Equations and details of operations are given for this case. Examples are given of size distributions of kaolins, clays, barytes and zinc oxide determined to  $0.03\mu$ . C.

**Nitrocellulose: Swelling.** G. V. Schulz. *Z. physikal. Chem.*, 1942, B 52, 253-6 (through *Chem. Abstr.*, 1943, 37, 5301<sup>6</sup>). At a concentration of 50 g. nitrocellulose per gram of acetone there is an abrupt change in free energy and heat of swelling. This is ascribed to the entrance of acetone into the cellulose lattice, which is in agreement with X-ray analysis. C.

**Starch: Hydration below Gelatinization Temperature.** W. Gallay and I. E. Puddington. *Canadian J. Res.*, 1943, 21 B, 179-185. The dilatancy of an aqueous starch suspension is particularly marked just above the freezing point and decreases with rise in temperature. The sedimentation volume increases correspondingly, and the degree of compactness of the sediment decreases with increase in temperature. Flocculation is apparent at temperatures  $10^\circ$  below the gelatinization point. It is concluded that there is a continuous increase in hydration of the starch with temperature, in the range below the gelatinization point. The hydration below the gelatinization point is essentially reversible. Starch which has been extensively dried before being dispersed in water shows little or no dilatancy, a lower gelatinization point and a higher sedimentation

volume. Dried starch has a high heat of wetting and it is suggested that this results in incipient gelatinization at the surface of the granules, leading to sticking and agglomeration, thus increasing the sedimentation volume and destroying dilatancy. C.

**Linear Polymers: Depolymerization.** A. Votinov, P. Kobeka and F. Marei. *J. Phys. Chem. (U.S.S.R.)*, 1942, 16, 106-114 (through *Chem. Abstr.*, 1943, 37, 5304<sup>9</sup>). Thermal data are recorded on the depolymerization of polystyrene and of polymethyl methacrylate in an oxygen or nitrogen atmosphere at temperatures from 200° to 300° and 350° to 450°, respectively. The energies of activation of depolymerization are: polystyrene, in oxygen  $E_1 = 10$  Cal. and in nitrogen  $E_2 = 34$  Cal.; polymethyl methacrylate, in nitrogen,  $E_3 = 25$  Cal. The heat of reaction of depolymerization for polystyrene is  $34 - 11 = 23$  Cal. as determined from the reaction or 21.9 Cal. as determined from the respective heats of combustion. The polymerization-depolymerization reaction must be considered as a reversible process. C.

**Nitrocellulose: Viscosity.** M. Goujon. *Chim. et Ind.*, 1939, 43, Suppl. to No. 8, 229-236 (through *Chem. Zentr.*, 1941, i, 2342 and *Chem. Abstr.*, 1943, 37, 5587<sup>9</sup>). On the basis of a discussion of methods for the determination of viscosity used in the United States and Germany, butyl acetate is recommended as a solvent. It is proposed that seven types of nitrocellulose be defined. The coefficient of viscosity is to be understood as the initial increase in  $\log \eta_{rel} = f(c)$ , in which  $c$  is weight per cent. C.

**Visco-elastic Materials: Flow in Capillaries.** A. C. Merrington. *Nature*, 1943, 152, 663. Viscosity determinations on rubber solutions and the like, using a viscometer in which the true pressure-drop along the capillary was measured directly, indicated the existence of an end effect. The ratio of the length to the diameter of the capillary is a significant factor and the apparent viscosity increases as this ratio decreases. The end "correction" deduced from the flow curves and expressed in tube diameters is proportional to shearing stress and also increases with concentration. It is suggested that the material on entering the tube is "stretched" or elastically deformed, until equilibrium is reached for the particular shearing stress applied, the material then flowing through the remainder of the tube in this state. For very long tubes, this "elastic end effect" would tend to become negligible in comparison with the over-all length, and flow curves would then give a true, or nearly true, representation of the behaviour of the material under the particular conditions. When the liquid emerges from the capillary it is still elastically deformed and will consequently tend to return to its former unstretched condition. This results in swelling of the emergent column of liquid which is easily observed. This swelling increases both with increasing stress and increasing concentration, the elastic recovery being proportional to the stress. Thus the "elastic end effect" which results in a difference in the flow curves, and the swelling of the emergent column of liquid, are related, and either should give a measure of the elastic property of the material. C.

**Sodium Amylopectin Glycollate: Viscosity.** F. Höppler. *Chem. Ztg.*, 1943, 67, No. 7-8, 72-76 (through *Chem. Abstr.*, 1943, 37, 5553<sup>9</sup>). Sodium amylopectin glycollate, from starch and sodium chloroacetate, forms highly viscous aqueous solutions. Quasi-viscosity values are determined. The replacement of gum tragacanth and several possible uses are discussed. C.

**Wood Nitrocelluloses: Viscosity.** H. Staudinger and E. Husemann. *Naturwissenschaften*, 1941, 29, 534-5 (through *Chem. Zentr.*, 1942, ii, 21 and *Chem. Abstr.*, 1943, 37, 5587<sup>9</sup>). Cellulose regenerated from cuprammonium solution gave nitrates with  $K_m$  (in acetone) of  $11 \times 10^{-4}$ . Native wood cellulose, isolated by treatment with chlorine dioxide and alkali, gave nitrates with  $K_m$   $11.5 - 23 \times 10^{-4}$ . These, after precipitation from cuprammonium, gave  $K_m$   $8.2 - 11.7 \times 10^{-4}$ . The conclusion is drawn that the high values given by native cellulose are due to the presence of groups other than glucose in the molecule. These are removed by treatment with alkali. C.

**Methylene Blue: Polychromatism.** R. E. Liesegang. *Z. wiss. Mikroskopie*, 1941, 58, 43-44 (through *Chem. Zentr.*, 1942, ii, 1443-1444 and *Chem. Abstr.*, 1943, 37, 5636<sup>1</sup>). Thin layers of gelatin, dyed with methylene blue and exposed to cold until complete evaporation of the ice, become completely colourless. By addition of a drop of water the blue is restored, to be lost again when dried in

the cold, but retained if dried at room temperature. If the drying is partly cold and partly warm, frost-like forms, partly colourless and partly blue, result. Gelatin solutions, converted to gelatose by heat, give similar colour changes, except that a deep red is produced by drying in the cold. Other related experiments are described. C.

**Triphenylmethane Dyes: Absorption Spectra.** P. M. Heertjes. *Chem. Weekblad*, 1942, 39, 210-215 (through *Chem. Zentr.*, 1942, ii, 642-643 and *Chem. Abstr.*, 1943, 37, 5314<sup>2</sup>). The ultra-violet absorption spectra of *p*-dimethylamino derivatives of triphenylmethane are reported from 230 to 350 m $\mu$ . As 3-5 molecules of hydrochloric acid are added to the solution of the carbinol, absorption shifts toward the visible, and the solutions obey Beer's law; in solutions of the leuco base, the shift is toward the short waves, and Beer's law is not obeyed until a large amount of hydrochloric acid has been added. Derivatives of triphenylmethane behave very much like toluene. In the leuco bases, all the dimethylamino groups play the same part; in the carbinols, addition of hydrochloric acid produces a rearrangement, probably of the Hantzsch type. In malachite green and crystal violet, addition of hydrochloric acid shifts the bands of longer wave length toward those of shorter wave length. C.

**Triphenylmethane Dyes: Absorption Spectra and Constitution.** E. Hertel and C. Leszczynski. *Z. physikal. Chem.*, 1942, B 53, 20-36 (through *Chem. Abstr.*, 1943, 37, 5653<sup>4</sup>). It is not possible to decide from the absorption spectra of *p*-dimethylaminotriphenylmethane, *pp'*-tetramethyldiaminotriphenylmethane, *pp'p''*-hexamethyltriaminotriphenylmethane, and the corresponding triphenylmethyl picrates whether the absorbing form of the ion has a benzoid, quinoid or resonant form. A comparison of the absorption spectrum of an equimolar mixture of *pp'*-tetraethyldiaminotriphenylmethyl chloride and *pp'*-diaminotriphenylmethyl chloride with that of *p*-amino-*p'*-diethylaminotriphenylmethyl chloride gives evidence of the resonant form. The rates of reaction of the three triphenylmethane derivatives and the corresponding picrates with methyl iodide lead to the same conclusion. The addition of a *p*-methoxy group to *p*-amino-*p'*-diethylaminotriphenylmethyl chloride gives an analogous shift in the spectrum to its addition to the picrate of *pp'*-tetramethyldiaminotriphenylmethane. The spectra of the three triphenylmethane derivatives are similar to that of *p*-dimethylaminotoluene. The equivalent conductivities of the picrates were determined. Directions are given for the preparation of *p*-amino-*p'*-diethylaminotriphenylmethyl chloride and the addition of a *p*-methoxy group. C.

**Lantern Slides: Preparation.** F. J. Van Antwerpen. *Chem. Eng. News*, 1943, 21, 1445-1448. Notes on the preparation of lantern slides are given under the following headings: preparing original charts and tables, reproducing printed matter photographically, slides by direct method, reproducing 35 mm. films as lantern slides, reducing lantern slides to 35 mm. slides, and non-photographic slides. C.

**Clouds and Dew: Formation.** J. W. Archbold. *Phil. Mag.*, 1943, [vii], 34, 632-642. On the basis of classical statistical mechanics, a preliminary study is made of condensation in the form of clouds and dew. It is shown that in cloud formation gravity appears to have no significant effect. In the absence of electrical charges, condensation tends to occur in large drops without any formation of cloud as the word is generally understood; and the minimum size of drops to be expected in quantity is given by Kelvin's formula, which decides the minimum size of single drop on which condensation will occur. The distribution in size depends on the distribution of electrical charge. If all the drops carry the same numerical charge there is still a tendency for condensation in large drops, whose minimum size is given by Thomson's formula which extends Kelvin's, but this is accompanied by a cloud of fine drops that may well be visible, whose sizes can be estimated by a formula given in this paper. Ordinary cloud formation is probably associated with temperature variation and departure from equilibrium conditions. The sizes of dewdrops obey a similar distribution law to that for cloud drops, and the degree of affinity of water for the surface on which condensation takes place is of importance in regard to the passage beyond supersaturation to condensation. C.

**Keratin Fibres: Reactivity of the Cystine Linkage.** IV. Action of Formaldehyde. J. L. Stoves. *Trans. Faraday Soc.*, 1943, 39, 294-300. Determination of the load/extension curves of keratin fibres before and after boiling

for 1 hr. in 2 per cent. formaldehyde pH 2-10 shows that at all pH values new linkages are formed, the greatest number, as estimated by the difference in behaviour of formaldehyde-treated and buffer-treated fibres, occurring in the neighbourhood of pH 7. At all pH values the amino groups of a proportion of the salt linkages take part in the reaction. In the case of fibres treated with boiling solutions of 2 per cent. formaldehyde below pH 3 or above pH 9, linkages are formed which are stable to 1 hr. in boiling 5 per cent. sodium metabisulphite. Fibres treated with boiling solutions of 2 per cent. formaldehyde pH 3-8 contain relatively few of these linkages. Linkages formed by treatment for 1 hr. with boiling 2 per cent. formaldehyde pH 6 confer upon the fibre a partial immunity to attack by oxidising agents. No increased resistance, however, is shown to hydrolysis by boiling water. The probable nature of the new linkages is discussed. W.

**Keratin Fibres: Reactivity of the Cystine Linkage. V. Action of Benzoquinone.** J. L. Stoves. *Trans. Faraday Soc.*, 1943, 39, 301-305. The effects of concentration, temperature and pH upon the reaction of *p*-benzoquinone with keratin fibres are examined. Changes in the load/extension curves of fibres treated with aqueous solutions at the boil, indicate that the reaction gives rise to the formation of new linkages within the fibres, thereby increasing the resistance of keratin to decomposition by hydrolysis and by oxidation. Using boiling solutions of 2 per cent. benzoquinone, maximum formation of new linkages occurs at pH 7. In more alkaline solutions extremely rapid polymerisation of the quinone greatly reduces the number of new linkages formed, the effect being particularly marked above pH 8. Suggestions are made as to the nature of the linkages as well as to those formed by the action of benzoquinone upon fibres whose cystine linkages have been reduced by pre-treatment with sodium metabisulphite. W.

## 10—ECONOMICS

**British Cotton Industry: Organisation.** United Textile Factory Workers' Association. *Textile Weekly*, 1943, 32, 703-704. The Legislative Council of the textile trade unions have produced a report of 159 pages, with 53 statistical tables, on "Ways and Means of Improving the Economic Stability of the Cotton Textile Industry." The main recommendations are summarised under the headings (1) Raw cotton (price control), (2) Spindles and looms, (3) Price fixing for yarns and cloths, (4) General working conditions, (5) Wage rates, (6) Recruitment and promotion, (7) Education and research, (8) Export trade in piece-goods, and marketing, (9) Structure of the Industry, (10) Finance, (11) Finishing section of the Industry, (12) Period of present Government control, and (13) Future of the Industry. The Report reaches conclusions in favour of the "socialization of the cotton industry." C.

**Textile Wholesale Prices, October, 1943.** *Bd. Trade J.*, 1943, 149, 425. The wholesale price index numbers for October are Cotton 136.2, Wool 182.4, Other textiles 131.0, All articles 162.5 (1930=100). C.

**Sheep and Wool Production: An American Analysis of Costs.** U.S.A. Tariff Commission and Farm Credit Administration. *Wool Rec.*, 1943, 64, 648, 650. Cost data are given for the wool clip for 1941, 1942 and 1943 (estimated). The data were supplied to the Commission in the form of averages for States or areas within States, and not on an individual ranch basis, thus protecting the privacy of each rancher's business. W.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Chlorinated Naphthalene Waxes: Skin Hazard.** L. Schwartz. *J. Amer. Med. Assoc.*, 1943, 122, 158-161 (through *Bull. Hygiene*, 1943, 18, 737). Chloronaphthalenes and chlorodiphenyls may cause acne-like lesions and even acute yellow atrophy of the liver. Electricians handling cables coated with these compounds tend to develop "halowax" acne or "cable rash." The lesions, which vary in size from that of a pinhead to the size of a pea, are pale straw coloured cysts, formed by plugging of the orifices of the sebaceous glands, resulting in retention of the secretion and in keratinization of the lining membrane. The lesions may be treated with a 10 per cent. solution of Igepon, Duponol, Aerosol,

Santomerse or Naccanol; comedones should be compressed and the cysts evacuated two or three times each week. For prevention, hood respirators, which efficiently filter out dust and wax, should be used; clean underclothes and overalls should be worn daily; shower baths should be taken after work. As a substitute for the hood respirator, a protective ointment may be applied to the face, neck and ears to coat the skin with a fine film; an alcoholic solution of shellac mixed with sodium perborate and zinc oxide is suitable. Precautionary liver function tests should be carried out. C.

**Highly Skilled Work: Fatigue Effect.** F. C. Bartlett. *Proc. Roy. Soc.*, 1943, B 131, 247-257. Most investigations of fatigue have been based on the repetition of elementary operations, such as easy calculations, word or colour recognition and naming, and expression of the resulting fatigue in terms of the diminution in quantity or quality of the work done. The skill fatigue of daily life is not, however, set up under such conditions. The operations involved in any highly skilled work are marked by complex, co-ordinated and accurately timed activities. The stimuli in response to which these activities are set up are neither simple nor do they usually fall into an order of fixed succession. They have the character of a field, or a pattern, which has become very highly organised, and may retain its identity in spite of a great diversity of internal arrangement. It is possible to develop fully controlled experimental situations in which these realistic considerations have full play. When this is done it is found that the "standards" accepted and followed by the central nervous system unwittingly deteriorate. The operator tends to think that he is doing better work, because errors treated as significant all the time get wider and wider limits. Until a stage of great fatigue is reached, it is far more likely that the right actions will be performed at the wrong times than that the wrong actions will be performed. If accurate timing is insisted upon, gross mistakes of action may appear. The stimulus field splits up. Its pattern character alters. It becomes a collection of unconnected signals for action, with some of these predominant over all others. Particularly, stimuli which are in the margin of the pattern, not closely organised with the central field, are ignored, "forgotten," and serious lapses of specific reactions occur. There is a marked change in the effect of certain "distracting," or additional stimuli. Sensations of bodily origin, in particular, become more pressing and insistent and affect the performance in ways peculiar to the tired operator. Side by side with all these changes go constant subjective symptoms. Verbal reports about any circumstances connected with known failure of performance become increasingly inaccurate, and errors are regularly projected upon objective conditions, or attributed to the interference of other people. There is a tremendous growth of irritability. The light thrown by this picture upon the relation of high-level central nervous functions to simpler neuro-muscular mechanisms is discussed. C.

**Industry, Research and Education: Organisation.** *Nature*, 1943, 152, 579-583. A review of the chief points raised in recent articles, memoranda and parliamentary debates on the need for industry to give greatly increased attention to research, for a system of taxation which will encourage instead of penalize modernization of equipment, for adequate remuneration of scientific workers, closer contact between scientific men in industry and the universities and better integration between research and development, adequate endowment of research at the universities, improvements in scientific and technical education, and the throwing open of the highest administrative positions in government service to technical and scientific men. C.

**Benzene Poisoning in Industry.** R. H. Wilson. *J. Lab. Clin. Med.*, 1942, 27, 1517-1521 (through *Chem. Abs.*, 1943, 37, 3527). The use of benzene in industry has increased, and the seriousness of poisoning from exposure, the need of constant medical supervision, the importance of early detection of absorption, desirable preventive measures and treatment of patients with various degrees of intoxication are discussed. As the best index of benzene absorption is the blood count, such studies were made on 1,104 people, employed in a rubber factory, who were exposed to fume concentrations averaging about 100 parts per million for varying periods of time. 7.5 per cent. showed slight absorption, and 2.2 per cent. marked absorption. Nine had severe aplastic anæmia and died. W.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### LIST OF ABSTRACTORS

*The Abstracts in this section of the "Journal" are supplied by the following Organisations, and the source indicated by the initials hereunder shown.*

British Cotton Industry Research Association	...	...	...	C.
British Launderers Research Association	...	...	...	La.
Bureau of Hygiene and Tropical Diseases	...	...	...	T.
Imperial Bureau of Animal Genetics	...	...	...	W.
Imperial Bureau of Plant Genetics	...	...	...	C. or L.
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### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL

**The Wool Clip at the Coast.** J. C. de Klerk. *Fmg. in S. Africa*, 1943, 18, 739-742. To qualify for wool to be sold to spinners, good classing is essential, and is discussed with regard to fleeces, backs, tender wool, odd lines, crutchings, lamb's wool and coarse and coloured wool. Examples show the monetary advantages of wool classing, details being given of original appraisal at the coast and subsequent appraisal by the broker. W.

**Sheep: Rugging.** T. K. Ewer. *N. Z. J. Agric.*, 1943, 67, 181-182. A trial rugging of Corriedale hoggets, under average winter conditions on the Canterbury plains, was not economic, from the point of view of increase of body weight, increase of fleece weight, or wool price. W.

**What is a Stud Sheep?** A. J. Pepler. *S. A. Merino Breeders' J.*, 1943, 5, No. 4, 8-10. The following definitions of a stud sheep are made and analysed: A stud ram or ewe (1) must be of pure blood, (2) should possess, in exaggerated degree, the characters desirable in a flock sheep. (1) Implies prepotency; (2) implies the presence of skinfolds, which, except for correlation with fibre density (a contention which has now been discounted), are a fault and should be discouraged. Constitution has been lost because, in the quest for wool, the sheep as the physiological instrument of production has been neglected. W.

#### (C)—VEGETABLE

**Raw Cotton: World Production.** *Textile Weekly*, 1943, 32, 903. Recent returns of world crops and acreages are summarised. The American crop for 1934-44 is estimated at 11,478,000 bales and the old stock in hand 10,580,000 bales. The estimated acreage under cotton in Egypt is 739,800, against 1,706,000 in 1941-42. The 1942-43 crop in N. Brazil is estimated at 355,600 bales (478 lb.)



compared with 468,600 bales in 1941-42; the quality is particularly good. The estimated crop in Argentina has increased to 438,200 bales (478 lb.). The Australian crop has just been picked and stands at 8,400 bales (478 lb.). The 1942-43 crop in El Salvador is about 13,800 bales (478 lb.). C.

**Annual Plants: Pulping.** R. Hornke. *Forsch. Ber. Zellwolle-u. Kunstseide-Rings G.m.b.H.*, 1942, No. 1, 54-59 (through *Chem. Zentr.*, 1942, ii, 1648 and *Chem. Abstr.*, 1943, 37, 6123<sup>a</sup>). A fibrous material low in ash and containing 38-39 per cent. cellulose was produced from air-dried potato stalks by treatment with a preliminary crusher and then in a wash vat. A usable semi-pulp similar to mechanical pulp was made from the purified coarse fibrous material by washing with dilute caustic soda and defiberizing. Acid pulping of potato stalks is impossible because of the sensitiveness of the fibres. Calcium hydroxide gives a dark-brown pulp. A bleachable pulp can be produced by the sulphate process. The fibrous material is more conveniently worked up than the untreated stalk chaff. Highly purified cellulose cannot be made from potato stalks. Spanish reed (*Arundo donax*) can be pulped by the sulphite and sulphate processes, but requires more chemical than wood. Nitric acid pulping takes place with 1.4 per cent. nitric acid at 95-100° and after-treatment with 1 per cent. caustic soda at 100-105°. The pulp has 94-95 per cent.  $\alpha$ -cellulose and is easily bleachable. Spanish reed is advantageously converted to pulp by the swelling process of Schieber. It can be converted to a semi-pure cellulose by treatment with nitric acid for 4-5 hours at ordinary pressure. C.

**Seaweeds: Occurrence and Applications.** F. E. Fritsch. *Endeavour*, 1943, 2, 142-147. An illustrated description is given of the common species of seaweed and mention is made of their application as the source of rayon (the alginate type). Hints are given of the magnitude of the crops. Thus, near Puget Sound (U.S.A.) the annual production is estimated at some 200,000 tons and the kelp beds covering about 400 sq. miles of the Californian coast are said to produce annually about 59,300,000 tons. C.

**Wood: Pulping.** G. Dupont and R. Escourrou. *Chim. et Ind.*, 1942, 47, 470-474 (through *Chem. Zentr.*, 1942, ii, 1648 and *Chem. Abstr.*, 1943, 37, 6123<sup>b</sup>). Experiments were performed on French and foreign types of woods. A satisfactory yield of paper with acceptable strength cannot be obtained from the dwarf- or Egyptian doom-palm by the alkali process; the nitric acid-soda process yields about 15 per cent. fermentable sugars. *Zizania* (water rice) can be pulped easily to suitable pulps with caustic soda at ordinary pressure. African umbelacacia is easily pulped with caustic soda under pressure or by the calcium bisulphite process. Maritime pine can be cooked with alkali or with sodium bisulphite. C.

**Rayon Spinning Pot Spindles: Reclaiming by Metal Spraying.** Metallizing Equipment Co. Inc. *Rayon Textile Monthly*, 1943, 24, 611-612. It is reported that Messrs. Courtaulds Ltd. in Canada are reclaiming about 5,000 spinning-pot spindles annually by turning down the worn bearing surface on a lathe and building it up again by spraying with a hard steel fed as wire to a "Metco" Type E. gun. The new spindle costs 9.10 dollars, but the repair costs only 50 cents. C.

**Rayon Spinning Bath Recovery System: Use of Nickel Tubing.** *Inco*, 1943, 18, No. 4, 21 (through *Nickel Bull.*, 1943, 16, 160). Economic production of rayon requires the recovery of the hardening-bath chemicals. Evaporators used in the process consist of vertical cylinders 5 ft. in diameter and 15 ft. high. Horizontal tubes, internally heated by steam, provide means for heating the hardening solution which circulates between the tubes. The outer shell of the evaporator is of lead and until recently the heating tubes were also of lead. Nickel, however, is more resistant than lead to attack by the liquor, is galvanically compatible with the lead shells of the evaporator, and is mechanically much stronger than lead. With thinner-walled tubing of nickel it has been possible to employ higher steam pressures and temperatures and to increase production from 30 to 230 tons per day. C.

**Rayon Spinning Solutions: Filtration.** A. G. Arend. *Silk J. Rayon World*, 1943, 23, October, 22-23, 41. Recent developments in the filtration of rayon solutions are reviewed with special reference to filter presses for viscose, disc filters for cuprammonium solutions, and a rotary vacuum filter. C.



**Cellulose Acetate Rayon: Manufacture; Temperature Control.** *Silk & Rayon*, 1943, 17, 918-920. The writer discusses the heat of reaction at various stages in the production of cellulose acetate and its control. A table summarises the proportions of acetic acid, acetic anhydride, and sulphuric acid used, the maximum temperatures reached, and the duration of the process according to (1) Miles, (2) Dreyfus, (3) Zdanowich, (4) Eichengrün, and (5) Hottenroth. A graph shows temperature plotted against time in hours for a continuous, commercial acetylation and for a step-wise laboratory process. C.

**Cellulose Hydrate Fibre: De-swelling with Formaldehyde.** K. Richter. *Zellwolle, Kunstseide, Seide*, 1942, 47, 635-638 (through *Chem. Abstr.*, 1943, 37, 6124<sup>8</sup>). Tests made involve the use of acids in an attempt to find a mild catalyst. Experimental data show the course of the reaction in the presence of equivalent amounts of different catalysts, the influence of formaldehyde concentration on the equilibrium concentration, the influence of the amount of catalyst on the equilibrium concentration for different catalysts, the establishment of the equilibrium relationships of swelling, degree of polymerisation and textile data, relative effectiveness of different catalysts, swelling and degree of polymerisation in the presence of hydrochloric acid. C.

**Viscose Rayon: Spinning.** W. Voigt. *Forsch.-Ber. Zellwolle-u. Kunstseide-Rings G.m.b.H.*, 1942, No. 1, 60-4 (through *Chem. Zentr.*, 1942, ii, 1755 and *Chem. Abstr.*, 1943, 37, 6134<sup>9</sup>). Increasing the strength of rayon by stretching has the disadvantage of causing the extensibility and utility to suffer. The author produced a strong thread with good extensibility and excellent crimping by using an aluminium sulphate bath. A suitable viscose has 2 per cent. resin, 0.7 per cent. zinc sulphide, a Hottenroth ripeness number of 11-12.5 and a falling-sphere viscosity of 40-80. The spinning bath has a temperature of 44-45°, a specific gravity of 1.33-1.34, 6 g. zinc sulphate per litre and 115-125 g. sulphuric acid per litre. The thread, after passing the Gallette wheel and first set of spools, enters a trough containing 15 per cent. aluminium sulphate. Upon leaving the trough, the thread is vigorously stretched by winding on faster spinning spools. At a titre of 3.2-3.5 the breaking length averaged 14.7 km. wet, 25.8 km. dry, and the extensibility was 18-25 per cent. wet, 16-19 per cent. dry. An improvement in the extensibility can also be produced by passing the thread between rotating soft rubber rolls. Machine spinning speeds are given. C.

**Casein Filaments: Production.** A. G. Arend. *Silk J. Rayon World*, 1943, 20, No. 235, 23-24. A brief review of the production of "artificial wool" by spinning a solution of casein. Mention is made of the use of the polarograph in process control. C.

**Rayon Staple Fibre: Production Problems.** J. Kleine. *Zellwolle, Kunstseide, Seide*, 1942, 47, 255-259 (through *Chem. Abstr.*, 1943, 37, 6124<sup>7</sup>). The preservation of raw materials, the recovery of chemicals used in spinning operations, the properties of the pulp, preparation of the spinning solution, spinning conditions, the method of after-treatment, etc., are discussed. C.

**Viscose Staple Fibre: Curling.** P. Eckert and H. J. Schmidt. *Zellwolle, Kunstseide, Seide*, 1942, 47, 483-489 (through *Chem. Abstr.*, 1943, 37, 6124<sup>8</sup>). Curling can be achieved by mechanical, physical and chemical methods. A detailed description is given of a successful curling device and experiments are described in which evidence is given about the conditions under which the best and most stable curling can be achieved. The influence of the ripeness and after-ripeness, respectively, the length of stirring and of the spinning bath on the character of the curled fibre is analysed. C.

#### (D)—ARTIFICIAL

**Nylon-Synthetic Resin Filaments: Production and Properties.** *Silk & Rayon*, 1943, 17, 677, 796. A review of new developments in the production of filaments from mixtures of nylon and phenol-formaldehyde resins, based on B.P. 545,940 and 545,941. C.

**Carbon Disulphide Vapour: Photometric Determination.** See Section 8C.

**Cuban Fibre Plants: Production.** Mary L. Blanco. *Rayon Textile Monthly*, 1943, 24, 533-4, 605-7. A review of the possibilities of Cuba as a source of textile fibres under the headings (1) Supplying Cuba with sacks for her sugar crop, (2) Malva fibre for "alpagartas" (fibre-soled slippers) and twine, (3)

Cultivation of luffa fibre, (4) Sansevieria fibre, (5) Rosella cultivation (sponsored by the U.S. Embassy), (6) Other fibres, and (7) the Henequen industry and rope manufacture. C.

#### PATENTS

**Polyalkylene Oxides: Application in Viscose Spinning.** British Cellophane Ltd. B.P.557,218 of 6/5/1942:10/11/1943 (Conv. 6/5/1941). Viscose is extruded into the coagulating bath in the presence of a small proportion of a material which is capable of preventing or retarding the formation of a deposit of solid particles on the walls of the orifice, and which comprises a polyalkylene oxide, soluble or dispersible in the viscose or in the coagulating bath and having a molecular weight of at least 400. The preferred polyalkylene oxides are those derivable from purely aliphatic alkylene oxides, e.g. polyethylene oxide. The polyalkylene oxide may be dissolved or dispersed either in the viscose or in the acid coagulating bath or in both. C.

**Cellulose: Production from Ligno-cellulosic Materials.** H. Dreyfus. B.P. 557,324 of 11/5/1942:16/11/1943. In the production of cellulose from ligno-cellulosic materials, the materials, after being delignified, are heated in a dilute aqueous solution of an acid, other than nitric and nitrous acids, and then treated with an alkaline solution to dissolve hemicelluloses. After treatment with the delignifying solution the material is preferably extracted with a dilute solution of sodium hydroxide or other suitable liquid in order to remove as much as possible of the lignin and other undesired constituents which have not been removed in the delignifying liquor, and is then subjected to the acid treatment, e.g. boiling for about an hour in 0.1-0.4 per cent. hydrochloric acid solution. The material may then be treated with 10-15 per cent. sodium hydroxide solution, boiled at atmospheric pressure or under pressure at 110°-120° C. with dilute sodium hydroxide solution (0.5-1 per cent.), and bleached. In this way substantially all the lignin and hemicelluloses may be removed, and a product containing 90 per cent. to 95 per cent. or more of  $\alpha$ -cellulose and less than 2 per cent. of hemicellulose obtained. This may be subjected to further alkali treatment for the removal of  $\beta$  and  $\gamma$ -celluloses. An alternative method of carrying out the process consists in subjecting the cellulose to the acid treatment immediately after the treatment with delignifying liquor after which it may be boiled with dilute alkali and then subjected to the more concentrated alkali treatment, bleaching, etc. C.

**Synthetic Linear Interpolyamides: Production.** E. I. Du Pont de Nemours & Co. B.P.557,544 of 19/9/1941:25/11/1943 (Conv. 24/2/1941). A process for the production of linear interpolyamides having a modulus of stiffness less than 50,000 lb./sq. in. comprises heating at polymerising temperatures X parts of 6-aminocaproic acid, Y parts of hexamethylenediammonium sebacate, Z parts of hexamethylenediammonium adipate, and T parts of the mixed salt of hexamethylenediamine and the acids obtained by the oxidation of oleic acid, where X does not exceed a maximum of 85 and its minimum value is

$$10 - 0.333T + (0.02 - 10^{-5}(T - 15)^2)(Z - 29.0 - 0.0208(T - 23)^2),$$

where Z and T have arbitrary values not in excess of 85 and where  $X + Y + Z + T = 100$ , the values for X, Y, Z, and T being positive and not more than one of them equalling zero. A process for the production of linear interpolyamides having a modulus of stiffness less than 50,000 lb./sq. in. and being soluble to the extent of at least 15 per cent. in an 80:20 mixture by volume of ethanol and water at 50 to 75° C., comprises heating at polymerising temperatures X parts of 6-aminocaproic acid, Y parts of hexamethylenediammonium sebacate, Z parts of hexamethylenediammonium adipate, and T parts of the mixed salt of hexamethylenediamine and the acids obtained by the oxidation of oleic acid, where X does not exceed a maximum of 85 and its minimum value is  $4 + 0.0073(T + 45)^2 + 0.0322(Y - 13 - 0.0043(T - 53)^2)^2$ , where Z and T have arbitrary values in excess of 85 and where  $X + Y + Z + T = 100$ , the values for X, Y, Z and T being positive and not more than one of them equalling zero. The products are useful for the preparation of wrapping foils, coatings for fabrics, paper, metal and other materials, adhesives, impregnating compositions and compression and injection moulding compositions. C.

**Rayon Cake Wrapping Device.** Kirklees Ltd. and W. Tong. B.P.557,768 of 26/9/1942:3/12/1943. A device for applying wrapping to rayon cakes or similar yarn packages comprises two jaws which can be moved to grip the cake after it has been placed over them, the relative movement of the jaws being

produced through a hand-operated lever so that the operator is unable to move the jaws until the cake is in position and his hands are free. The jaws are hollow and each jaw is formed with a semi-annular collar or platform, at a distance below the top of the jaws slightly less than the depth of the cake, to receive and support the cake when it is placed around the jaws. Either one or both jaws may be movable and operated by means of a hand lever moving around a quadrant fitted with a pawl and ratchet arrangement, the pawl of which can be released when desired. C.

**Skins and Hides: Depilating.** W. Neugebauer (to Kalle & Co. A.-G.). D.R.P. 712,507 of 25/9/1941 (through *Chem. Abs.*, 1943, 37, 4592). Skins and hides are treated simultaneously or consecutively with sulphites and proteolytic enzymes. To the above two are added water-soluble salts of tri- or tetrathionic acid. The treatment with the thionates precedes or is simultaneous with the proteolytic enzyme treatment. W.

**Wool-like Cellulose Acetate Rayon: Production.** Heberlein & Co. A.-G. (Wattwil, Switzerland). B.P. 557,876 of 1/5/1942:9/12/1943 (Conv. 2/5/1941). A process for the manufacture of wool-like rayon from cellulose derivatives, especially cellulose acetate rayon, is characterised in that, prior to, during or after over-twisting, the rayon is impregnated with water-soluble, and not readily volatile swelling agents, such as dioxane, glycol monoacetate, monoacetate or glycol mono ethyl ether, and after the over-twisting is subjected to a dry heating treatment in the presence of the swelling agent, which is eliminated, if desired, not until after the untwisting, the yarn being finished in the usual manner, after being twisted in reverse beyond the neutral point and, if desired, after soaping. Dyeing may be carried out either before or after the treatment. It is also possible to produce the wool-like rayon directly by adding the swelling agent to a dry-spinning solution, imparting the requisite over-twist to the resulting threads and dry heating. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Blowroom and Cardroom Machinery: Maintenance.** Dan Walters. *Cotton (U.S.)*, 1943, 107, No. 10, 97-99, 103. Hints are given on routine inspection, oiling and renewal, under a 3-shift system, of opening, scutching, carding, combing, drawing and slubbing machinery. Report forms are shown for (1) card grinding and (2) fly frame inspection. C.

**Cotton Opening and Spinning Machinery: Developments.** W. A. Hunter (Messrs. Howard and Bullough Ltd.). *Textile Weekly*, 1943, 32, 856-862. A report of an address and discussion on modern trends in cotton spinning with special reference to the reduction in the number of blowroom and speed-frame processes. New machines, including the Shirley high-speed dust-extracting cage, are briefly mentioned. C.

**Card Sliver Compacting Springs: Application.** *Cotton (U.S.)*, 1943, 107, No. 9, 132-135. Reports from 12 mills are reproduced where trials have been made of small springs at the ends of the doffer calender rollers on carding engines to make more compact slivers. It appears that such springs can be fitted without much alteration to the gearing or adjustment of the card but some of the reports are adverse on the score of yarn quality. C.

**Card Wire: Grinding.** F. Charnley. *Textile Weekly*, 1943, 32, 739, 740, 742, 782, 783. A report of a lecture and discussion on practical considerations in the grinding and setting of card wire. In the light of actual experiments, best results appear to be obtained under the following conditions. (1) Grinding rollers are carefully used and maintained, and the emery is changed at fortnightly intervals. (2) The setting of grinding rollers is made a specialized task, and left to a few men whose work has been found satisfactory. (3) The grinding is carried out by the "fast" method. (4) The grinding takes place at frequent intervals, but not necessarily so frequently as the common practice of once a fortnight. (5) The grinding is lightly done, and card settings are adjusted after each grinding. C.

**Neps: Origin and Removal.** E. H. Helliwell. *Textile World*, 1943, 93, No. 9, 84-85, 150. The characteristics of neps are described and their associations with the type of cotton, ginning, and conditions in the blowroom and cardroom are outlined. C.

**High-density Cotton Bales: Processing in American Mills.** M. E. Campbell. *Textile Research*, 1943, 13, No. 11, 18-20. In normal times, American Upland cotton is compressed to high density for export only. Considerable quantities of such cotton have, however, recently been diverted for domestic use. Modern blending feeders, coupled with vertical or Buckley-type openers have been found to be effective in handling high-density cotton, and mills so equipped experience little or no difficulty with the bales, although blending with cotton of lower density is not recommended. For mills with obsolete opening equipment, the only solution lies in conditioning either the opened bale or the opened lint. According to the machinery builders, little can be gained by way of modifying old-style equipment, although lower feeder production and closer kicker and doffer roll settings may help. Tests have shown that the compression of cotton to 33 lb. or more per cu. ft., the equivalent of high-density compression, is not harmful to the quality of the fibres when cotton of reasonably good grade is used. The blending of cotton of different densities is detrimental to the uniformity of cotton yarn. An investigation of bale cutting in compressed bales has shown that the cuts are caused by the shearing action of unequal pressures in adjacent parts of the bale. The most common cause of these unequal densities is the "dog ridges" which result from the action of the dogs at the sides of the press boxes of most gins. Severe cutting results in only negligible damage, and this can be eliminated by modifications in bale pressing equipment. C.

**Noble Combing: Fibre Breakage.** W. H. Robinson. *Text. Merc.*, 1943, 109, 583-584, 587. A discussion of the four points on the Noble comb where fibre breakage may be expected: the dabbing motion, the initial combing point, and the inside and outside drawing-off points. The lowest percentage of breakage occurs at the inside and the highest at the outside drawing-off point. W.

#### (B)—SPINNING AND DOUBLING

**Cotton Mill: Post-war Planning.** A. Draper. *Textile Weekly*, 1943, 32, 890-894. A report of an address on desirable developments in machine design and lay-out, improving mill conditions for the operatives, cost accounting, and textile education. C.

**Cotton Spinning Mill: Reorganisation.** *Textile Recorder*, 1943, 61, November, 30, 32, 35. In continuation of a previous series the writer discusses the influences of large-package spinning on ring spindle design, driving and lubrication and the importance of the quality of bobbins. C.

**Ring Frame Driving Motor: Power Requirements.** E. A. Untersee. *Textile World*, 1943, 93, No. 9, 98-99 (from paper read before *Amer. Inst. Elect. Eng.*, Jan., 1940). The author has measured the horse-power required to drive Whitin 216-spindle and 348-spindle frames with various rings, yarn counts, spindle speeds and amounts of yarn on the package. The results are plotted as graphs from which it appears that the power required varies as  $1/4 \cdot 75 \sqrt{\text{count}}$ , as (ring diameter in inches) $^{1.42}$ , and as (Spindle r.p.m.  $\div$  1000) $^{2.04}$ . From these relationships a table is calculated that gives the number of spindles per horse-power for rings of  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ ,  $1\frac{3}{4}$ , 2,  $2\frac{1}{4}$ ,  $2\frac{1}{2}$ ,  $2\frac{3}{4}$  and 3-inches diameters, spindle speeds from 12,000 to 5,000 r.p.m. and yarn counts from 2 to 30. It is believed that the figures are approximately correct for all makes of ring frame. Graphs are also given to show how the power required varies as between the empty and the full bobbins, between the bare spindles and spindles with bobbins, and between bare spindles with and without the front rollers running. The power consumed in winding and overcoming the friction of the balloon and traveller is clearly marked. C.

**Rubber Roller Cots: Advantages.** Vulcascot (Great Britain) Ltd. *Textile Mercury and Argus*, 1943, 109, 615-616. It is claimed that drafts may safely be increased by 20 per cent. by covering the middle rollers of draw frames, speed frames, ring frames and mules with Vulcascot rubber cots. The material is a synthetic product, not affected by oil, and of a high coefficient of friction. C.

**Single-apron High-drafting Device.** F. Dunkerley. *Textile Manufacturer*, 1943, 69, 491. Drawings are given of a high-drafting device invented in 1937-38 in which a single apron carried by the bottom middle roller (a) and a tensor bar (b) presents a flat drafting surface under a leather-covered roller (c) and a non-rotating drag bar (d), (c) being vertically over (a) and (d) over (b). The device was used to draft  $\frac{15}{16}$ -inch American draw-frame sliver into

2½-hank roving and  $\frac{3}{16}$ -inch Indian sliver into 1.6-hank roving. The only drawback was the accumulation of fluff and short fibre. C.

**Single-end "Mule" for Learning Piecing-up.** R. Jalbent. *Textile World*, 1943, 93, No. 9, 139-140. An illustration is given of a "mule" with only one spindle and no winding-up motion which has been found useful and economical for teaching learners to piece-up broken ends. C.

**Speed-frame Products: Effect of Doubling on Yarn Strength.** *Cotton (U.S.)*, 1943, 107, No. 9, 130. The writer reports actual yarn tests to show that the Draper standards for yarn strength can be reached with few doublings, so long as the count spun is not above 20. The mill uses  $\frac{15}{16}$ -in. Middling cotton for warp yarns up to 30's and 1-in. Middling for 30's. A 14.8 oz. lap is put up at the cards to make a 55-grain sliver with a draft of 113. Sixteen ends are put up at the sliver lapper. The draw-frame makes a 53-grain sliver with draft of 16.14, and high draft systems are used on the roving frames. There are only 16 doublings in the cardroom and 16 or 32 in the spinning room. C.

**Ring Frame Pneumatic Full-bobbin Stop-motion.** E. F. Culbreath Co. *Textile World*, 1943, 93, No. 10, 99. An illustration is given of a stop-motion which is actuated by compressed air. As the bobbin builds up the ring rail eventually trips the lever of an air valve. The lever is adjusted for the desired size of bobbin. C.

#### (D)—YARNS AND CORDS

**Twist in Yarns: Need for International Notation.** *Wool Rec.*, 1943, 64, 726. The American method of Z and S twist is explained and recommended for universal adoption. W.

#### PATENTS

**Laminated Plastic Pressing and Drawing Roller.** T. H. Laird. B.P.557,465 of 2/6/1942:22/11/1943. A pressing and drawing roller for use in machinery for preparing or spinning fibrous materials, such as cotton, wool, flax, hemp or jute, is formed of one or more layers of granulated cork, rubber or leather or sawdust of plane tree or sycamore arranged alternately with thin layers of woven fabric, such as cotton or linen, fabric layers being located on the outside and the whole being impregnated with a suitable resin, preferably a phenol-formaldehyde resin, and compressed into a homogeneous layer of the required thickness. C.

**Spinning Frame Yarn Separator Plate Cleaning Tool.** British Celanese Ltd. B.P.557,535 of 21/5/1942:24/11/1943 (Conv. 31/5/1941). A tool for cleaning the separator plates of spinning and twisting machines comprises pivoted handles and wiper blades carried by extensions of the handles beyond their pivot points the construction and arrangement being such that the wiper blades are in parallel relationship when a separator plate is gripped between them. Preferably one of the wiper blades is pivotally mounted on its handle extension, and spring means are provided to urge the wiper blades toward each other, the arrangement being such that when the handles are forced together the wiper blades are moved apart against the action of the spring. C.

**Elastic Filament Covering Apparatus.** Filatex Corporation (New York). B.P.557,742 of 21/7/1942:2/12/1943 (Conv. 9/8/1941). A process for the production of a uniform covered elastic filament comprises advancing an elastic filament under a pre-determined stretch, applying one or more spiral coverings of strands from one or more supply packages and increasing the rate of advance of the elastic filament without varying its stretch, in accordance with a schedule pre-determined by observation of the effect on the maximum obtained stretch of the covered filament which accompanies dissipation of the covering material from the supply package. The apparatus comprises means for supplying elastic filamentary material to a tension roll, a second tension roll to which the filament is passed, a variable speed mechanism for driving the two tension rolls so that the second rotates at a definitely greater speed than the first, one or more hollow spindles through which the elastic filament passes while passing from one tension roll to another, means for supporting a package of elongate covering material on each side of the spindles, means for rotating each of the spindles to apply the elongate covering material in spiral form about the elastic filament, and means operated in accordance with a pre-determined schedule for progressively increasing the rate of passage of the elastic filament through the spindles without varying the difference in the speeds of the tension rolls. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Ply Warp Yarns: Preparation for Weaving Duck.** Donald Burns. *Cotton (U.S.)*, 1943, 107, No. 10, 100-101. The writer describes how he solved the problem of preparing ply yarns for duck (about 10's/3) in a mill equipped with Barber-Colman high-speed spoolers and warpers, normally employed on fine single yarns and not capable of taking the large twister bobbins. A Foster winder was fitted with cams to match the traverse on the Barber-Colman spooler and with spindles to accommodate the Barber-Colman cheese cores. The cheeses wound on the Foster winder were then transferred to the usual Barber-Colman high-speed warper for winding into section beams. The warps obviously contained knots but this did not matter in the cloth concerned. It is calculated that the saving in waste and in labour amounted to nearly 27,400 dollars in a 50-week year, against which the cost of the new equipment was 16,000 dollars. C.

**Rayon Yarn: Warping.** H. Marsden. *Textile Manufacturer*, 1943, 69, 484-486, 493. A practical account is given of the general properties of rayon yarns in relation to warping systems, types of warp creel yarn packages, and measuring yarn tension and package density (with the Sipp-Eastwood instruments). C.

**Winding Machines: Cleaning and Oiling.** W. F. Crowder. *Textile World*, 1943, 93, No. 10, 80-81. Factors of machine and operative efficiency in winding are briefly discussed and a "lubricating and cleaning chart" for hanging in a conspicuous place in the winding room is reproduced. C.

#### (B)—SIZING

**Constant-speed and -tension Wire Lacquering Machine.** Industrial Oven Engineering Co. *Textile World*, 1943, 93, No. 9, 121. A diagram is given of a machine for lacquering wire at constant speed and constant tensions in unwinding and winding up. It is thought that some modification might be suitable for processing yarn when close control of tension is required. The following modifications are available: (1) friction unwind with controlled processing speed and tension-controlled wind up, (2) driven unwind and wind up with controlled speed and tension, (3) friction unwind using capstan drive and having a slip belt for the wind up, and (4) friction unwind and wind up having slip belt drive. C.

**Rayon Warps: Sizing.** L. Sonneborn Sons Inc. *Rayon Textile Monthly*, 1943, 24, 590-592. Some experiments are reported on the use of mixtures of gelatin and the following softeners for sizing rayon warps: (1) a sulphonated blend of castor oil and pine oil, (2) a blend of coconut oil and sulphonated oil of the olive oil type, (3) petroleum sulphonates, and (4) a soft, saponifiable wax called "Glycerol 700," with the wetting agent "Penequik." The advantages of the mixtures, especially No. 4, are shown in tables of (1) viscosities, (2) weights of size taken up, and (3)-(6) analyses of oil and size on the cloth before and after exposure to the ultra-violet lamp and after washing with water and with soap. A set of photographs shows that a film of gelatin alone has a wrinkled surface that becomes smoother with the addition of softener, No. 4 giving a very smooth film. Suitable size recipes are given for 75-den. acetate warp, 75-den. viscose warp and 35-den. 60-fil. Bemberg warp for flare cloth, 105 ends per inch. C.

#### (C)—WEAVING

**Automatic Box Looms: Adjustment.** R. B. Pressley. *Cotton (U.S.)*, 1943, 107, No. 6, 83-86; No. 7, 89-92; No. 8, 73-75; No. 9, 86-87. Detailed directions are given to guide tacklers in the adjustment of automatic box looms, including the newest types. The illustrations relate to Crompton & Knowles looms. C.

**Automatic Looms: Staffing.** (1) P. L. Greenhalgh. (2) H. de G. Gaudin. *Textile Manufacturer*, 1943, 69, 473. (1) The writer raises questions about some of the statements made by Gaudin in a previous discussion and states that figures for the "looms per weaver" often ignore the ancillary labour. (2) In reply, Gaudin agrees that the "looms per operative in the shed" is the important figure, but claims that whilst this figure is seldom more than 10 or 12 in this country it is often 24-30 in the United States and on the Continent. C.

**Heald and Reed Calculation Table.** R. D. Sharrock & Sons. *Textile Weekly*, 1943, 32, 910. A table is reproduced that gives the number of heald eyes and reed dents corresponding with counts 28, 30, 32, 36.....64, 72 and cloth widths of 32, 34.....60, 66 and 72 inches. C.

**Rayon Loom Race Plate: Covering to Prevent Abrasion of Warp.** *Cotton (U.S.)*, 1943, 107, No. 10, 102-103. To prevent abrasion of the rayon warp, it is a common practice to cover the race plate with a material into which the warp ends can sink. Corduroy is recommended for coarse warps and plush for fine. The slay ends and the covering must be brought to the same level and if the ends are otherwise true it is advisable to plane down the race plate to make room for the covering. Other adjustments to reduce wear on the warp are also mentioned. C.

**Terry Fabrics: Weaving.** O. Pomfret. *Textile Manufacturer*, 1943, 69, 470-473. An illustrated account is given of the special factors of loom mechanism, setting and timing that have to be considered in terry weaving. C.

**Terry Towel Loom.** Wilson and Longbottom Ltd. *Textile Recorder*, 1943, 61, October, 36-37; November, 38-39. A detailed, illustrated description of the various special features of a terry towel loom. C.

**Eccentrically-driven Warp Stop-motion.** "Benlow." *Silk J. Rayon World*, 1943, 20, No. 234, 26-27. A detailed, illustrated description of an eccentrically-driven warp stop-motion, by Messrs. Mather & Platt Ltd., that occupies only about 3 inches at each end of the loom and thus permits the utilisation of more reed-space than other devices. C.

**Electric Warp Stop Motion.** Crompton & Knowles Loom Works. *Silk J. Rayon World*, 1943, 20, No. 231, 22-24; No. 233, 24-26. A detailed, illustrated account is given of a new warp stop-motion actuated by low-voltage a.c. current supplied from a transformer mounted on the switch box of the loom, each loom operating independently. C.

**Woollen, Worsted and Cotton Warps: Weaving.** *Textile Weekly*, 1943, 32, 188, 190, 193, 428, 430, 432, 456, 458, 536, 538, 542. Practical hints are given on points to watch during the weaving of woollen, worsted and cotton warps. C.

**Rheology in the Textile Trade.** British Rheologists' Club. *Nature*, 1943, 152, 514-5. A report of a meeting at which a discussion took place on the applications of rheology to weaving, especially to the operation of a modern ribbon loom. A poor view was taken of the engineering ability of many designers and builders of textile machinery in general. It was asserted that "tenacity" of yarn (breaking strain in ounces per denier) does not necessarily measure its probable behaviour in weaving. W.

(D)—KNITTING

**Circular Knitted "Utility" Stockings: Production.** *Textile Manufacturer*, 1943, 69, 505-506. "Utility" cotton stockings plated with rayon (Nos. 727, 731 and 765) and cotton lisle stockings (725 and 728) are seamless, circular-knitted full-fashioned stockings with mock seaming and fashioning marks that are said to fit well and to resist laddering. A series of photographs shows various stages of manufacture. C.

**Full-fashioned Hosiery Mills: Optimum Temperature and Humidity.** *Textile World*, 1943, 93, No. 10, 95. The change from silk to rayon, nylon and Vinyon involves readjustments in the air-conditioning system. Optimum conditions are given in the following table:

		Silk	Nylon	Cotton	Rayon*	Acetate
Throwing	...	60-65%	45-50% at 80-85° F.	—	55%	50% at 80° F.— 55% at 88° F.
Knitting	...	65%	48% at 80° F.	60%	60-70%	55% at 80° F.

\* Viscose and cuprammonium.

**May Hosiery Mills Yarn Supply Conveyors.** See Section 8E.

(G)—FABRICS

**American Army Wind-resistant Sateen: Construction and Processing.** *Textile World*, 1943, 93, No. 9, 94-95. Particulars are given of the construction and official methods of testing a popular, wind-resistant 9-oz. sateen made in 5-shaft and 4-shaft crow-foot weaves. An outline is given of a suitable programme of spinning, weaving and finishing to meet the specification. C.



**American Army Cotton Duck No. 6, Type I: Construction and Processing.** *Textile World*, 1943, 93, No. 10, 90, 91, 138, 140. An abstract is given of the official specification governing No. 6 cotton duck Type I (plain weave; 20.74 oz. per sq. yd. minimum; ends and picks at least  $36 \times 26$  of 3-ply yarns; breaking load at least 335 lb. warp-way, 250 lb. weft-way, by  $1 \times 1 \times 3$ -inch grab test), and a suitable complete mill organisation for meeting the requirements is set out, from the raw cotton to the finished cloth. A diagram shows an appropriate arrangement of the let-off, healds and take-up on Crompton and Knowles duck looms. C.

**American Services Parachute Fabrics: Construction.** *Textile World*, 1943, 93, No. 10, 65-68. Particulars are given of the constructions and specified requirements of various parachute fabrics for dropping troops, cargo, flares, bombs and mines. Nylon, high-tenacity acetate rayon, Fiberglas and viscose rayon yarns are used. C.

**Cellulose Acetate Cargo Parachute Fabric: Development.** Tennessee Eastman Corporation. *Rayon Textile Monthly*, 1943, 24, 599-600. It is announced that a  $4\frac{1}{2}$ -oz. fabric of high resistance to impact, and also cords and tapes have been produced for cargo parachutes from a special brand of acetate rayon. The parachutes, 24 ft. diameter, meet the American Air Corps demand that they shall withstand the shock of opening when dropped with a 300-lb. load at a speed of 150-200 miles per hour, and descend at a rate of not more than 30 feet per second. C.

**Barré and Irregular Rayon Fabrics: Causes and Remedies. Cloth Defects: Points System for Grading. Jacquard Fabric Defects: Description. Wool Blankets: Structure and Thermal Transmission.** See Section 5C.

#### PATENTS

**Nylon Reinforced Rubber Structures.** E. I. Du Pont de Nemours & Co. B.P.536,133 of 1/11/1939:5/5/1941 (Conv. 1/11/1938). Reinforced rubber structures (e.g. tyres) contain as the reinforcing element a filamentous structure composed of an oriented synthetic linear polyamide. The reinforcing element may be a multi-filament structure having a twist not exceeding four turns per inch and an extensibility of 15-50 per cent. Alternatively the reinforcing element may be a monofil structure. The oriented linear polyamide may be polyhexamethylene adipamide. C.

**Knitting Machine Picker Mechanism.** W. E. Booton Ltd. and W. E. Booton. B.P.557,184 of 5/5/1942:9/11/1943. Picker mechanism of the kind comprising a pivoted driving arm and a pivoted driven arm, at least one of which is movable about two axes, and a driving connection between them, is characterised by adjustment means, other than the driving connection, for adjusting the relationship of the two arms. The picker assembly or battery comprises a number of picker mechanisms one above the other, and each incorporating a picker arm capable of swinging about two axes, and a guide for its movements, and is characterised by a support body consisting of a casting, forging or stamping machined across at different levels to provide a number of super-imposed recesses each for the reception of a picker mechanism and each separated from the next by a platform integral with the support body, each platform being transfixcd by at least one pivot pin for the picker mechanism, and, for each picker mechanism, a picker-arm guide which consists of a flat plate. C.

**Thermal Insulation Material.** Lister & Co. Ltd. and W. Garner. B.P.557,212 of 2/4/1942:10/11/1943. Thermal insulation material comprises two textile fabrics into which are woven connecting textile elements so that the fabrics are spaced apart at least one-sixteenth of an inch and a relatively large volume of air is contained between them. The space between the fabrics is largely filled with a comparatively loosely packed, air-trapping mass of fibres produced wholly or in part by the connecting textile elements, which may be lightly twisted or loosely packed yarns or composed of crimped or curled fibres. Alternatively, the connecting elements may be resiliently flexible or closely packed, or both, so that the fabrics are held spaced apart with resistance to compression. In addition to the connecting elements, fibrous packing in the form of singles yarn, roving or sliver, which is not woven into either of the fabrics, may be introduced between the two fabrics. The outer fabrics may be sprayed or coated with metal, rubber or other substance, or be woven with a float of rayon or other material. C.



**Yarn Winding Machine.** British Celanese Ltd. B.P.557,219 of 6/5/1942: 10/11/1943 (Conv. 8/5/1941). A yarn winding machine comprises a winding spindle, a traverse guide, and means adapted to operate independently of the growth of the package for causing the guide to recede steadily from the package so as to maintain it in close proximity to, but spaced from the surface of the package. A convenient general arrangement of traverse guide and withdrawing means comprises a pivoted frame adapted to carry the traverse guide and mounted on the same shaft as a cam by which the guide is traversed to and fro along the length of the package. Driving means, actuated by the rotation of the shaft, may be provided to pivot the frame about the shaft so as to withdraw the traverse guide steadily from the rotating spindle. The traverse frame may be actuated by means of a rack fixed to the frame of the machine, and a pinion carried by the traverse frame and adapted to roll along the rack, the pinion being the last of a train of gears of which the first is mounted on and rotates with the cam shaft. C.

**Weft Replenishing Loom Thread Control Mechanism.** Crompton & Knowles Loom Works, U.S.A. B.P.557,300 of 1/7/1942:15/11/1943 (Conv. 28/1/1942). A weft-replenishing loom having a magazine for supporting a group of reserve bobbins is provided with a thread holder for the weft of a bobbin which has dropped or been discharged from the magazine to a position lower than that of a properly transferred bobbin and means, operated by a part of the loom, to cut the weft end of such dropped or discharged bobbin. The magazine of reserve bobbins is ordinarily located above the lay and the weft ends of the reserve bobbins extend downwardly toward the thread holder. When a bobbin is discharged from the magazine in a revoking operation its thread extends downwardly from the thread holder into the bobbin can and is therefore away from the space occupied by the other weft ends. The thread cutting mechanism has a range of action below the weft threads of the reserve bobbins in the magazine but is in position to sever the thread of a discharged bobbin in the bobbin can. The thread holder may also be adapted to hold the weft ends of the reserve bobbins in the magazine and may be a pneumatic thread holder. C.

**Circular Loom.** J. Balsach (Buenos Aires). B.P.557,382 of 10/4/1942: 18/11/1943 (Conv. 10/4/1941). A circular loom comprises (1) a sectional reed each fraction of which comprises a cam-operated springheld lever, (2) means for adjusting simultaneously the tension of the springs of all the reed fractions, (3) means for compensating the tensions of the warp threads, (4) means for embodying together and braking the corresponding bobbins for the warp threads and (5) means controlled by the ending or breaking of a warp thread for automatically stopping the loom. C.

**Ladder-resistant Knitted and Non-slip Woven Fabrics: Production.** H. E. Brew. B.P.557,420 of 15/5/1942:19/11/1943. In a method for the production of fabric which, by an adhesion treatment subsequent to knitting or weaving, has the yarn united to itself at certain of the crossing points, a single yarn is employed which at some parts only of its surface is inert to the adhesion treatment, and the adhesion treatment is such that the adhesive state produced causes mutually-contacting adhesive parts to unite whilst, in general, an adhesive part will not unite with a non-adhesive part. The yarn may be of a non-adhesive substance and coated at intervals with an adhesive-forming substance or it may be composed of an adhesive-forming substance and coated at intervals with a resist. For example silk or viscose rayon yarns coated at intervals with a film of cellulose acetate or synthetic resin, or a cellulose acetate yarn coated at intervals with starch, dextrin or gelatin may be used. The single yarn may also be a filament formed of or coated with rubber or a rubber-like substance, and the treatment selected to produce adhesion will then include the use of a suitable solvent for the rubber, which will gelatinise or soften the rubber sufficiently to allow two softened parts to unite, without destroying the continuity of the filament and without causing an adhesive part to unite with a non-adhesive part. Ladder-resistant knitted fabrics and open-woven and slack-woven fabrics which are not liable to slip may be produced in this way. C.

**Knitting Machine Additional Thread Severing and Controlling Means.** B. Toone (Nottingham) Ltd., R. N. Toone and L. Allen. B.P.557,458 of 15/5/1942:22/11/1943. An independent needle knitting machine is provided with arrangements for feeding an additional thread, e.g. a plating, splicing or

patterning thread, and, while it is still running to and being knitted by the needles, severing it so that all the thread extending from the point of severance to the needles is knitted in, and re-introducing the same or a different thread with a free end extending beyond the point of introduction which free end is of such a length that the needles in descending to knit absorb or draw in such length and knit it. The resulting fabric is free from protruding ends of thread. When applied to a circular knitting machine of the type in which the needles rotate relatively to the thread feeders, a feeder for an additional thread is provided together with means for severing such thread while it is still running to and being knitted by the needles so that the loose end is all knitted in, means for anchoring the severed end (i.e. the end of thread extending from the supply to the point of severance), and means for re-introducing such end across the needle circle and for releasing such severed end so that on re-introduction the severed end is completely knitted in and no loose threads or floats are formed. C.

**Circular Knitting Machine.** W. E. Booton Ltd. and W. E. Booton. B.P. 557,485 of 19/5/1942:23/11/1943. In a circular knitting machine having instruments equipped with two rows of butts at different levels, which rows, during a picking phase in the operation of the machine, are each subdivided into a leading sub-group and a trailing sub-group at different levels, the second trailing sub-group directly following the first leading sub-group, and picker mechanism for progressively picking butts from the trailing end of each leading sub-group to take their places at the leading end of the associated trailing sub-groups, the first trailing sub-group is at least as long as the second trailing sub-group, and the driving member on being displaced rides along and is held displaced by the first trailing sub-group until it reaches the end thereof and the picking member is held by the retention of the driving member from catching among and/or rubbing along the butts of the second trailing sub-group until the end of the latter is reached, the driven and picking members being then free to resume their original attitudes ready to operate again. Since there is no danger that the picking member will catch among them, the butts of the second row may be more widely spaced apart than those of the first row. The space between the butts of the second row may be at least as wide as the butt-engaging end of the picking member. C.

**Rayon Bolting Cloth: Production.** Courtaulds Ltd. and R. A. McFarlane. B.P. 557,486/7/8 of 19/5/1942:23/11/1943. (1) Bolting cloth, grit gauze and the like is made by weaving in a leno weave artificial thread containing one or more continuous filaments, and causing the warp and weft threads to adhere at their crossings and thus prevent them from slipping over one another by treating them with a non-aqueous solution of a resin-like polyhydric alcohol-polybasic acid condensation product, either as such or modified as for instance by heating with oil and/or urea or urea-formaldehyde condensation products. Threads of viscose rayon having a dry tenacity of at least 3 gm. per denier are particularly suitable for use in the production of bolting cloth of this type. (2) Bolting cloth, grit gauze and the like is made by weaving in a plain and/or leno weave nylon threads containing one or more continuous filaments and causing the warp and weft threads to adhere at their crossings and thus prevent them from slipping over one another by treating them with a resin-like polyhydric alcohol-polybasic acid condensation product in presence of from 0.1 to 20 per cent., calculated on the weight of the resin, of an organic compound which is a wetting agent for the nylon and which assists the nylon to take up the resin-like condensation product. The wetting agent may be diphenylguanidine, phenol or trichlorethylene. (3) Bolting cloth, grit gauze and the like is made from a thermoplastic artificial thread containing one or more continuous filaments woven in a leno weave in which the threads are prevented from slipping over one another by thermally welding the warp and weft threads at their crossings, with or without the use of a swelling agent. Suitable thermoplastic threads include cellulose acetate threads and threads of a resin such as that obtained by the copolymerisation of vinyl chloride and vinyl acetate. Acetone and trichlorethylene are suitable solvents. C.

**Stocking Blanks: Production on Circular Knitting Machines.** W. E. Booton Ltd., W. E. Booton and H. Witts. B.P. 557,629 of 25/5/1942:29/11/1943. A method of manufacturing a blank for a stocking of the like mainly by rotary

knitting comprises fashioning the leg by the control of the number of needles in knitting activity to produce an upwardly converging gap in the back of the rotary knit leg fabric, and producing heel parts united at their ends to the fabric of the back of the leg and of the foot bottom by knitting on two spaced groups of needles, one at each side of the gap left by inactive leg-fashioning needles, while temporarily restraining instep needles, located between the groups, from knitting activity. A machine for this purpose includes two spaced groups of heel needles with fashioning needles between the groups at one side and instep needles between them at the other, means for producing a fashioned leg by varying the number of fashioning needles in activity during rotary knitting and for thereby forming a tapering gap up the back of the leg fabric, and means for producing loops of heel fabric by temporarily restraining the instep needles from knitting activity while the two groups of heel needles continue to knit. The toe is produced as a single tapering width of fabric by controlling the number of needles in knitting activity. The toe may be knitted by instep needles. The heel may be produced by causing the instep needles to hold their loops, continuing to knit on the heel needles during rotation, and finally re-introducing the instep needles into activity. Alternatively the heeling needles may knit by oscillation. C.

**Polyamide Knitting Yarns: Sizing.** E. I. Du Pont de Nemours & Co. B.P. 557,783 of 29/4/1942:6/12/1943 (Conv. 14/5/1941). For the production of sheer knit goods, especially fully-fashioned hosiery, substantially free from snags and pulled threads, synthetic linear polyamide yarn is sized with a film-forming solution of serum globulin, glycinin, edestin, gliadin, zein, hordein, oryzenin, maize glutelin, casein or vitellin. The protein sizing composition may contain plasticizing agents, hardening agents and lubricants, and is preferably applied to the yarn in the form of an aqueous solution to which solubilizing agents such as dilute alkalis or acids are added, if necessary. The conditions are preferably so regulated that the quantity of solid sizing material deposited on the yarn will comprise from 1 per cent. to 20 per cent. of the weight of the dry yarn. C.

**Cop Winding Machine.** G. G. Barker (Maschinenfabrik Schärer, Erlenbach, Switzerland). B.P. 557,861 of 5/6/1942:8/12/1943. A cop winding machine having means for producing a thread reserve is provided with a thread guide which is displaced by automatic means along an axially reciprocating thread guide carrier rod into a position appropriate for producing the thread reserve and can then be coupled to the rod for common movement therewith by means of a locking device, for the purpose of producing the spool winding proper, whereupon the thread guide is intermittently advanced along the thread guide carrier rod by means of a separate winding feeler member. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (A)—PREPARATORY PROCESSES

**Aerosol-OT: Toxicity.** See Section 11.

##### (B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Cotton Fabrics: Scouring.** G. Herman. *Sherstyanoe Delo*, 1940, 19, No. 9-10, 14-15 (through *Chem. Zentr.*, 1941, i, 2061-2062 and *Chem. Abstr.*, 1943, 37, 6135<sup>9</sup>). The essential feature of the process is the treatment of the raw fabric with a hot, mineral acid solution of "Contact" (sulphonaphthenic acid), which removes size and partially frees the material from substances containing pectin, nitrogen, fat and wax. Three modifications of the process are described. C.

**Uniform Cloth: Improving Serviceability by Careful Washing and Milling.** H. Mendrzyk, H. Sommer and O. Viertel. *Wiss. Abhandl. deut. Materialprüfungsanstalt.*, 1940, 1, No. 6, 34-64 (through *Chem. Zentr.*, 1942, II, 608 and *Chem. Abs.*, 1943, 37, 4577). Studies were made on (1) the effect of different washing operations over a pH range of 5-11, with the use of soap and soda as a standard of comparison, (2) the extent in each of these cases of additional damage caused by dyeing, and (3) the effect of different milling procedures over a pH range of 2-11 on various pre-damaged woollens. The washing and milling process developed by Hansa-Werke Lürmann, Schütte & Co. and used in the manufacture of uniform cloth, was compared with the usual standard processes and the fatty alcohol sulphonate type of washing and milling agent (Böhme Fettchemie). It is concluded that wool can be washed without any difficulty

in neutral or slightly acid baths (pH 6.7 and 4.5, respectively). This causes on the average less damage to wool and lower residual fat content than the usual alkaline washing. When washed in a neutral or acid medium, wool becomes more voluminous, open and lively, less felted and somewhat lighter in colour; because of slighter swelling it requires a shorter drying period; the danger of bacterial decomposition is also avoided. Milling can be done at pH 2.11; however, in the case of the neutral or faintly acid rinsing operations somewhat larger amounts of the washing agents must be used. The wearability of the cloth is not significantly affected by the type of washing process used; the slightly acid washing is apparently more advantageous. Among the milling operations the Böhme process and the strongly acid milling process are poorer, and the faintly acid and the neutral milling processes are somewhat better than the average. In alkaline washing and milling excessive concentrations and temperatures will cause damage which appreciably lowers the wearability; however, in neutral or faintly acid washing, no appreciable damage will occur. Dyeing has a much greater effect than washing and milling. Since the wearability improves with increasing colour depth and chrome dyeing is better than vat dyeing, it is recommended to replace white wool in mixtures by lightly dyed or chromed wool. Detailed tables and diagrams are shown. W.

#### (D)—MILLING

**Union Fabrics: Milling Shrinkage.** C. S. Whewell, M. A. M. Eid, N. Kokmen and M. C. Lui. *J. Soc. Dyers & Col.*, 1943, 59, 233-240. The milling shrinkages of various types of union fabrics were determined. The fabric structures examined were as follows: (i) warp, cotton; weft, wool, chlorinated wool, cellulose acetate rayon, casein fibre, Ardil (peanut fibre), Fibro, Rayolanda X, and blends of these with wool; (ii) warp, worsted; weft, wool, Fibro, Rayolanda X, and blends of these with wool; (iii) as in (ii), but using woollen instead of worsted yarns. Fabrics with a cotton warp showed that (a) small amounts of untreated with chlorinated wool greatly increased its feltability; (b) fabrics from 50/50 mixtures of wool and cellulose acetate rayon milled much less than all-wool fabrics; (c) blends of wool and casein fibre felted readily; (d) Ardil gave a similar result to casein fibre; (e) Fibro, Rayolanda X and blends of these with wool, reduced the shrinkage of the fabric slightly, Fibro having the greater effect. Similar experiments with Fibro and Rayolanda X and a worsted warp showed that fabrics containing wool and Rayolanda X shrank more quickly than those containing wool and Fibro, the shrinkage of a 50/50 wool/Rayolanda X fabric being considerably greater than one of 100 per cent. wool, whereas the shrinkage of a 50/50 wool/Fibro mixture was only slightly greater. With woollen yarns, Rayolanda X gave a much more feltable fabric. W.

#### (E)—DRYING AND CONDITIONING

**Infra-red Gas Generator: Drying Efficiency.** F. G. McGlaughlin. *Textile World*, 1943, 93, No. 10, 88; *Textile Research*, 1943, 13, No. 12, 21-23. The writer corrects errors in papers by Grapnel. He points out that the quantity of heat that a wet cloth receives by radiation depends on the area of the incandescent surface and increases very rapidly as the temperature of the burner surface rises. The amount depends on the difference of the 4th powers of the absolute temperatures of the cloth and burner surfaces. (See Grapnel; *J. Text. Inst.*, 1943, 34, A691; the errors in question are not reproduced in the abstract.) C.

**Textile Fibres: Drying.** A. C. Walker. *Trans. Amer. Soc. Mech. Engr.*, 1943, 65, 329-336 (through *Chem. Abstr.*, 1943, 37, 6135<sup>2</sup>). Hysteresis effects are common in textile fibres. A fibre in equilibrium with moisture under certain conditions, when dried and then re-exposed to the same equilibrium conditions may or may not regain its original moisture content. The temperature of drying, humidity of the drying air and the rate of drying affect the hysteresis as well as the ultimate strength and lasting qualities of the fibres. Wool when treated with water containing 0.5 per cent. and 4.5 per cent. sulphuric acid absorbs less water than untreated wool. Treatment with alkali solution increases the water absorption of wool. Cabinet driers materially reduce the drying time of package cotton and yield cotton of uniform quality. Rayons and purified cotton are sensitive to drying temperatures. High humidity at any temperature is more harmful than low humidity. Carpet wool shows the degrading effect of humidity somewhat more than clothing wool, as does mercerised cotton and acetate rayon. C.

## (F)—CARBONISING

**Carbonised Loose Wool: Neutralisation.** R. B. Sweetten, A. J. Farnworth and W. R. Lang. *Text. J. Australia*, 1943, 18, 182-184, 223, 234-245, 241. Laboratory scale investigations are reported on the factors controlling the neutralisation of carbonised loose wool, i.e. the alkali concentration, the time and temperature of immersion and the weight ratio of liquor to wool. The results are given for both merino 64s and crossbred 46s. For an initial acid content of 4-10 per cent. sulphuric acid by weight in the wool, the residual content after neutralisation in a 5 g. per l. soda ash solution is practically independent of the original acid content. A preliminary water rinse (3 bowl) set removes slightly more acid than a 2 bowl set lacking the preliminary rinse, other conditions being equal. The removal of acid by a 5 g. per l. soda ash solution is identical for liquor/wool weight ratios from 50 upwards, but for a weaker 1 g. per l. solution the curve falls to a minimum at 500, the former concentration being therefore a safe experimental figure. The increase in the concentration of the soda ash liquor causes a decrease in the residual acidity until, at 3-4 g. per l., the decrease is very small. Increased time of immersion gives a lower residual acidity, although a minimum is indicated after 20 min. Increase in temperature of the liquor causes an inverse linear change in the residual acid content. W.

## (G)—BLEACHING

**Bleaching, Dyeing and Finishing: Developments.** *Textile Weekly*, 1943, 32, 913-921, 959-960. A useful, broad review of modern developments with particular reference to the processing of the newer man-made fibres. C.

**Caustic Soda and Liquid Chlorine: Precautions in Handling.** United States National Safety Council. *Textile World*, 1943, 93, No. 9, 102-103. The hazards encountered in handling caustic soda and liquid chlorine are described, precautions to be observed are enumerated, and first-aid rules for treating injured persons are given. C.

**Bleaching Agents and Dyehouse Chemicals: Safe Handling.** United States National Safety Council. *Textile World*, 1943, 93, No. 10, 96-97. The hazards encountered in the handling of bleaching agents (hypochlorites and peroxides), chlorates and perchlorates, and acetic acid are stated, and precautions to be taken are enumerated. C.

## (H)—MERCERISING

**Mill Adhesives: Selection.** G. B. Cloran. *Textile World*, 1943, 93, No. 10, 98. A brief discussion of suitable adhesives for (1) lining shuttles, (2) labelling hosiery, (3) bonding carpets to a backing fabric, (4) giving a gripping surface to the back grey cloth on a printing machine, (5) flock printing, (6) labelling and sealing in the packing department, and (7) winding paperboard tubes. C.

**Crease-resisting Spun Rayon Fabrics: Properties.** Union Fabrics: Milling Shrinkage. See Section 5C.

## (I)—DYEING

**Azoic Dyeings: After-treatment.** *Textile Weekly*, 1943, 32, 608-610, 748-752. Practical hints are given on the purpose and practice of the after-treatment, especially soaping, of azoic dyeings and prints. C.

**Iron Impurities: Effects in Dyeing and Finishing.** *Textile Manufacturer*, 1943, 69, 499-500. The writer reviews sources of contamination by iron in dyeing and finishing, some defects caused thereby in wool, rayon and silk dyeing, and methods of stain removal. C.

**Utility Heavy Overall Fabrics: Processing.** *Textile Manufacturer*, 1943, 69, 494-6, 502. Particulars are supplied of the "utility" range of overall fabrics and directions are given for indigo, mineral khaki and sulphur dyeing, starching and shrunk finishing. C.

**Viscose Rayon: Level Dyeing.** *Silk & Rayon*, 1943, 17, 570-2, 810-812. The author reviews the factors that influence the levelness of dyed rayons, under the headings, (1) Influence of sizing on dyeing (practice of tub sizing; tests for gelatin), (2) Some effects of uneven crêping and dulling; (3) Affinity of dyes for viscose rayon (direct dyes; vat dyes; effects of alkali). C.

**High-temperature Water Heating System: Application in the Dyehouse.** See Section 7C.

**Sulphur-dyed Materials: Accelerated Ageing Tests.** See Section 5C.

**Dyeing English and Welsh Coarse Fleece Wool.** "Concord." *Text. Merc.*, 1943, 109, 338-341, 343, 368-369. The dyeing is described of English and Welsh coarse fleece wool which is kempy and oily, the only preparatory process being tearing up the fleece into pieces by hand, after untwisting the tail. The breaking up is necessary to prevent clotting in the dyebath. Chrome colours are generally used. The natural oil tends to retard dye absorption and to foul the apparatus; on the other hand it protects the wool in subsequent processing and enables milling to be done without the addition of olein to the soap solution. Methods are described of obviating faulty circulation of liquor in the dyeing machinery.

W.

(J)—PRINTING

**Nitrocellulose Lacquers: Use of Water as Diluent.** A. Kraus. *Farben-Ztg.*, 1942, 47, 199-200, 212-214 (through *Chem. Abstr.*, 1943, 37, 6124<sup>6</sup>). Water (5-7 per cent.) may be added to nitrocellulose lacquers in the presence of water-miscible solvents without turbidity effects in the solution or film. The tolerance for water varies directly with the temperature and indirectly with the concentration of nitrocellulose.

C.

(K)—FINISHING

**Gingham and Denim Finishing Ranges: Variable-speed Driving.** A. G. Arend. *Textile Weekly*, 1943, 32, 822, 824. The writer advocates the use of variable-speed drives to the units in the range of machines for finishing gingham and denims. One 40-h.p. motor can be used to drive a brusher, starch mangle, tenter frame and dryer and calender rolls for gingham, or the range of 1st and 2nd mangles and six stacks of 10-roll steam-heated drying cylinders for denims, the units being exactly synchronized for continuous processing.

C.

**Glycerin: Textile Applications.** Georgia Leffingwell and M. A. Lesser. *Rayon Textile Monthly*, 1943, 24, 493, 543-4. A summary of recent suggestions for the use of glycerin in printing, sizing, finishing, the manufacture of alkyd resins, and knitting.

C.

**Starch: Chemistry and Application.** *Textile Recorder*, 1943, 61, August, 44-50; November, 46-48. A useful summary is given of recent work on the chemistry of starch and its bearing on the starching process. Filling materials and antiseptics used in starching are also mentioned.

C.

**Blanket Manufacture: Raising Process.** A. J. Ryan. *Text. J. Australia*, 1943, 18, 258. The raising of blankets, the last processing operation, has an important effect on three of the major requirements of a blanket: (a) tensile strength, (b) weight and size and (c) warmth retaining properties. The latter property depends upon the blanket containing pockets of air in the fibrous pile. The advantage gained by damp raising, i.e. minimum loss of fibre and of tensile strength, is considered to be offset by the extra risk of soiling, and the handling involved. The best results are obtained by the gradual working up of the fibres by running the goods over the machine twice each side, and reducing the pile and counter-pile action each round. In the care of the raising gig, it is necessary to keep the card clothing in efficient working condition and free from flock, to harmonize the relative speed of the pile and counter-pile rollers, to keep the tension of the driving belts firm and to lubricate regularly all roller and shaft bearings.

W.

**Plastics in the Textile Industry.** F. S. Brown. *Wool Rec.*, 1943, 64, 682-690. After a survey of the main types of plastics and their characteristics and uses, an outline is given of their textile applications as materials of plant construction, in the treatment of fibres and fabrics, and as the raw materials vinyon and nylon. Their future possibilities are also discussed.

W.

(L)—PROOFING

**American Army Plastic Coated Fabrics: Production.** *Textile World*, 1943, 93, No. 9, 92-93. A brief, illustrated account is given of new types of water-proofed fabric in which vinyl and ethylcellulose plastics are used in the coating media. They include, for example, (1) a rain-suit made from two thicknesses of cotton fabric cemented by a vinyl resin, (2) a rain-suit made from fabric coated on both faces, (3) a sleeping bag padded with kapok and coated with polyvinyl acetate, and (4) a cover and sail for a life-raft, finished yellow on one side for ease of detection and blue on the other for camouflage. Many war-time uses of such fabrics are mentioned.

C.

**Pile Fabric: Shower- and Water-proofing.** *Textile Mercury and Argus*, 1943, 109, 641-644. Hints are given on the shower- and water-proof treatment of velvet, plush and imitation fur, especially with aluminium acetate ("red liquor"). C.

**Fire-resistant Duck: Testing.** See Section 5C.

**Insect-repellent Uniform and Underwear Fabrics: Production.** *Textile World*, 1943, 93, No. 10, 98. It is reported that German soldiers in Libya had uniforms and underwear made from fabrics that had been treated with a vegetable tanning material obtained from birch trees. The material had a lasting aromatic odour that repelled insects. C.

**Rubber: Purification.** T. R. Dawson and E. A. M. Thomson. *J. Rubber Research*, 1943, 12, 99-111. A critical review of literature on the purification of rubber with regard to electrical insulation in general and submarine electrical insulation in particular. The primary importance of water absorption in relation to electrical properties is emphasized and the chemical nature of rubber constituents and their effect on water absorption are studied. It is pointed out that the improvement of rubber for electrical insulation rests fundamentally on the removal of those non-rubber constituents which promote water absorption. Practical methods for effecting this removal are discussed. C.

**Water-repellent Fabrics: Production.** A. Chwala and A. Martina. *Kolloid Z.*, 1943, 102, 69-85 (through *Chem. Abstr.*, 1943, 37, 6136<sup>a</sup>). The development of processes for rendering fabrics water-repellent and patent literature thereon are reviewed. Emulsions for the one-bath process are based on waxes, protective colloids, dispersing agents and soluble aluminium or zirconium salts. The size of dispersed particles must be less than  $20 \times 10^{-5}$  cm. to penetrate properly. The extent of impregnation was found to be independent of the charge on the dispersed particles. Of tests for water-repellency such as angle of wetting, rain test, pressure of penetration, and water adsorption, the latter was found most significant and reproducible. C.

**Moth and Carpet Beetle Proofing Agents: Testing. Waterproof Fabrics: Testing.** See Section 5C.

**Wool: Mothproofing.** R. S. Hartley, F. F. Elsworth and J. Barritt. *J. Soc. Dyers & Col.*, 1943, 59, 266-271. The importance of damage to keratinous materials by moth larvae is emphasised, and the life cycle, feeding habits and digestive system of the common clothes moth are described. Methods for protecting wool from larval attack, by impregnation with mothproofing agents and by modification of the keratin structure, and methods of testing the resistance of proofed material to larval attack are reviewed. When using mothproofing agents containing fluorine, estimation of the fluorine content of the wool may be used as an indication of the degree of mothproofing, and it is shown that when the fluorine content of the treated material is of the order of 0.2-0.3 per cent. it may be regarded as being satisfactorily mothproofed. The fluorine contents of samples treated by some processes employing fluorides have been determined before and after washing and it is shown that the fluorine is substantially removed from the wool during washing. W.

**Waterproofing without Rubber.** *Dyer*, 1943, 90, 245-247. A survey of the use of fats and waxes, and of polymeric compounds and synthetic resins for waterproofing textiles. W.

#### PATENTS

**Sulphones: Production and Use in Dyeing and Printing.** Manchester Oxide Co. Ltd., J. H. Clayton and B. Bann. (1) B.P. 513,473 of 29/3/1938:13/10/1939. (2) B.P. 546,277 of 27/9/1940:6/7/1942. (3) *Textile Mercury*, 1943, 109, 493-497. (1) In a process for the thiocyanogenation of aniline or o-toluidine, the amine is treated in solution with a solution of an inorganic thiocyanate and a cupric salt, and the reaction medium from which the product has to be recovered is mainly water. The reaction may be carried out in the presence of a limited quantity of an acid, preferably oxalic acid, and in the presence of an organic solvent, such as alcohol. (2) A process for the production of p-aminophenyl sulphones from p-thiocyananiline and its derivatives other than o-alkoxy derivatives comprises acetylation of the amino group, reduction of the thiocyanate group to a mercapto group, conversion of the mercapto group to a thioether group by treatment with an etherifying agent, oxidation of the



thioether group to the corresponding sulphone group, and hydrolysis of the acyl group from the amino group. (3) The preparation of sulphone bases and their use for dyeing and printing azoic colours are discussed. 3-Methyl-4-aminophenyl ethyl sulphone, when diazotised and coupled with Naphthol AS-TR, yields a scarlet dye which gives on cotton shades of very good fastness to light, washing, bleaching and even boiling in soda ash solutions. With 4-amino-3-methoxyphenyl butyl sulphone, as the diazotisable base, yellowish scarlet shades are produced on cotton. Sulphones of this type, which contain an alkoxy group, give dyeings with superior resistance to alkali, boiling and soaping. C.

**Peracids: Preparation and Use in Bleaching.** E. I. Du Pont de Nemours & Co., J. S. Reichert, S. A. McNeight and A. A. Elston. (1) B.P.550,490 of 4/7/1941:11/1/1943. (2) *Textile Mercury*, 1943, 109, 605, 607, 616. (1) Aqueous solutions of organic peracids and their salts are prepared by reacting an organic acid anhydride with an alkaline solution of an inorganic active oxygen-yielding compound having a pH of at least 10 and a concentration not greater than that corresponding to 3-Vol. strength. Suitable inorganic compounds include hydrogen and sodium peroxides and alkali metal perborates, perphosphates, percarbonates and persulphates. The process is particularly suited to the preparation of monopercids from phthalic, acetic, succinic and maleic anhydrides. Temperatures up to about 90° C. may be used. The peracid solutions may be used directly for bleaching and other purposes. (2) The constitution and preparation of the organic peracids are discussed and data are given showing the effects of pH and temperature on the conversion of acetic and succinic anhydrides to the corresponding peracids by treatment with hydrogen peroxide and sodium perborate. When the peracid solutions are used for bleaching cotton, the most satisfactory results are obtained when the bleaching bath is maintained at pH 6 to 9. For goods containing coloured effects, bleaching at a pH of 6 to 7 is recommended. A suitable procedure for the bleaching of cotton muslin is outlined. In a comparison of different methods of bleaching, sodium hypochlorite bleaching and peracid bleaching gave a better white on cotton muslin than ordinary hydrogen peroxide bleaching. When the samples bleached by these three methods were given a second bleaching with peracid the final results were about equal. When peracids are used there is little danger of damage or degradation of the cotton. C.

**Duffel Coats, etc., for Wear under Arctic Conditions.** M. Stanton. B.P. 556,306 of 29/9/1943. A duffel coat has a permanently attached hood and a detachable helmet, and is intended to be worn under the usual oilskins. The garment is made of three or more thicknesses of material stitched together. The outer layer is cotton or similar material (preferably waterproofed), the intermediate layer oilskin, which is claimed to give exceptional warmth, and the inner layer lambs' wool, fur or woven wool material, or a combination of these. W.

**Oil, Water- and Petrol-proofing Compositions: Application.** A. M. Cowan. B.P.557,179 of 14/3/1942:9/11/1943. Asbestos millboard is made oil-, water- and petrol-proof by treatment with a composition comprising 60 to 80 parts by weight of a mixture in approximately equal proportions of a boiled drying oil and an unboiled drying oil, 18 to 27 parts by weight of a drying solvent boiling between 285° and 395° F., and 8 to 12 parts by weight of a solution of a water-insoluble metallic soap in an organic solvent in the proportion of 3 to 5 parts of solvent per part of soap. The preferred drying oils are linseed oil and tung oil, the former being the more suitable. The drying solvent is preferably white spirit or a solvent naphtha, and conveniently the same solvent may be used for dissolving the metal soap. C.

**Resin Filled Paper: Production.** Tootal Broadhurst Lee Co. Ltd., H. Corteen, R. P. Foulds, J. T. Marsh and F. C. Wood. B.P.557,182 of 5/5/1942:9/11/1943. A strong paper having a high water retention is made by treating a paper carrying synthetic resin with a solution capable of swelling cellulose under conditions which, if applied to cellulose, would produce substantial mercerisation. Preferably shrinkage of the paper is allowed to take place. The synthetic resin can be associated with the paper-forming materials or the paper in various ways, e.g. by application in the pulp stage or in the beater, or by application after partial drying of the paper, or by application to the dried sheet. The resins may be incorporated in the form of uncondensed reacting



components, first-stage condensation crystalline compounds, or non-crystallisable further condensed products; in the first two cases it is necessary to subject the material to a hardening treatment before the swelling treatment with caustic alkali solution. C.

**Fabric Milling Machines: Weighting the Lid of the Trough.** F. Naylor and J. Shaw. B.P.557,196 of 9/11/1943. Pressure exerted on the lid of the trough is controlled from the front of the machine and indicated on a scale, the pressure being applied to the lid through a spiral spring. An auxiliary spring is provided which, when the main loading spring ceases to act, partially or wholly neutralises the weight of the lid. W.

**Self-adhesive Surgical Bandage: Production.** A. P. Shaw. B.P.557,323 of 14/4/1942:16/11/1943. Self-adhesive surgical bandage is made by coating or spraying a continuous length of textile gauze fabric with a thermoplastic artificial resin dissolved in a solvent with admixture of plasticizer, and driving the solvent off by a partial drying, so as to leave the artificial resin and combined plasticizer finely distributed over the meshes of the gauze fabric without forming a continuous film, whereby a bandage cut from the treated fabric does not adhere to materials such as the human skin but is self-adhesive. Alternatively there may be used a suspension formed by dissolving the resin in a non-water soluble solvent and mixing this solution with water or with a mixture of water and a water soluble solvent. The thermoplastic resin is preferably a co-polymer of two vinyl compounds, e.g. a vinyl halide and a vinyl organic ester. Polyacrylic resins, polystyrenes, methyl methacrylate, coumarone or indene resins or isoprene artificial rubber may also be used. C.

**Garment Extremities: Finishing.** British Celanese Ltd. (Celanese Corporation of America). B.P.557,329 of 12/5/1942:16/11/1943. In a process for finishing the extremities of garments, e.g. the bottoms of cuffless trousers, by turning in an edge of the fabric of the garment and attaching the turned in portion to the main portion of the fabric, the attachment is made by bonding the two plies with the aid of heat and pressure to opposite faces of an interlining strip of flexible material containing an artificial organic thermoplastic film-forming substance. The interlining may be a film of artificial organic thermoplastic material or may be a fabric consisting of or containing yarns of artificial organic thermoplastic fibres alone or in admixture with non-thermoplastic fibres. The interlining is preferably a woven fabric containing yarns of cellulose acetate or other thermoplastic fibre in admixture with yarns of cotton or other non-thermoplastic material. The bonding step can be facilitated by the presence of a liquid having a softening or solvent action on the thermoplastic fibres at elevated temperatures. C.

**Elastic Laminated Fabric: Production.** A. S. Bell and E. L. Greenwood (British Celanese Ltd.). B.P.557,369 of 13/5/1942:17/11/1943. A laminated fabric comprises a number of fabric plies bonded together at intervals, by means of a thermoplastic material, in such a way that along a line parallel to one edge of the laminated fabric, areas in which the plies are bonded alternate with areas in which they are free, each of the fabric plies having structural elasticity in the direction of the line, so that the laminated fabric is elastic in that direction. Preferably the plies are bonded together by thermoplastic fibres contained in one or more of them. A particularly useful construction comprises an inner ply of fabric, which may be termed the interlining, composed of thermoplastic and non-thermoplastic fibres so distributed that along lines parallel to one edge of the fabric, bands containing thermoplastic fibres alternate with bands containing only non-thermoplastic fibres, the structure of the fabric being such that it is elastic along such lines, and two outer plies, one bonded to each face of the interlining by the thermoplastic fibres in the interlining, these outer plies being structurally elastic in the same direction as the interlining. The thermoplastic fibres in the interlining are preferably plasticised. Knitted fabrics are particularly suitable for use in the production of laminated fabrics. The outer-ply fabric may be a knitted fabric of unplasticised thermoplastic fibres or non-thermoplastic fibres or both. The bonding together of the plies by the thermoplastic fibres may be effected by pressing the assembly of fabric plies at an elevated temperature. The method described is useful for the production of sweat bands for hats, chin straps, belts, harness, etc. C.

**Disazo Dye: Production.** J. R. Atkinson, M. Mendoza and Imperial Chemical Industries Ltd. B.P.557,373 of 15/5/1942:17/11/1943. A disazo dye is made by diazotising 4-nitro-4'-aminodiphenylamine-2-sulphonic acid, coupling in alkaline medium with 1:8-aminonaphthol-3:6-disulphonic acid, diazotising the monoazo compound so obtained and coupling with resorcinol. The product dyes leather in shades varying from dark green to greenish-black.

C.

**Organic Mercury Compounds: Application in Rot-proofing.** M. FitzGibbon. B.P.557,375 of 15/5/1942:17/11/1943. Vegetable fibre materials are proofed against bacterial and fungoid attack by intimately incorporating in them water-soluble mercurised aromatic compounds. The mercury compound may be incorporated by immersing the material in a solution of the compound in an organic solvent, e.g. a solution of phenyl mercury chloride in creosote oil may be used. Preferably a water-insoluble halide is formed *in situ* by immersing the fibres in an aqueous solution of a water-soluble salt and then treating with a solution containing halogen ions. For example, the fabric may be immersed in an aqueous solution of phenyl mercury acetate or tolyl mercury acetate and then transferred to a solution of common salt. When waterproofing is also desired phenyl mercury chloride may be applied in the form of a dispersion in a latex or other waterproofing medium.

C.

**Water-resistant Paper: Production.** Tootal Broadhurst Lee Co. Ltd., J. T. Marsh and J. Tankard. B.P.557,389 of 16/5/1942:18/11/1943. A process of treating paper to increase its resistance to swelling in presence of water vapour, water and swelling agents consists in bringing it in contact with an excess of a solution containing a small proportion of an acid or potential acid and a large proportion of a reactive aldehyde, removing the excess of solution, drying the impregnated paper and heating it for a short time at a temperature above 100° C. The aldehyde is preferably formaldehyde and the reaction is preferably performed in presence of 1.6-2.6 g. of ammonium chloride (or its chemical equivalent of another acid or potentially acid substance per 100 g. of formaldehyde. The highest wet strength on the treated paper is secured when the amount of combined formaldehyde is not more than 0.5 g. per 100 g. of paper. Small amounts of acid-absorbing substances, such as urea, melamine, cyanamide, hexamine, etc., may be added to the impregnating liquor to lessen the initial acid attack. Buffer substances, wetting agents, softeners, waterproofing agents, etc., may also be added. The treated paper may be treated with swelling agents to produce compacted material of improved mechanical properties. After impregnation and before final heating to cause condensation of the aldehyde and cellulose the paper may be glazed, embossed, crinkled or otherwise mechanically treated or deformed or shaped. After heating to cause condensation of the aldehyde and cellulose such mechanically-produced effects are resistant to the effects of water and other swelling agents.

C.

**Aluminium Stearate Solutions: Preparation.** British Thomson-Houston Co. Ltd. B.P.557,411 of 3/12/1941:19/11/1943 (Conv. 4/12/1940). Comparatively concentrated aluminium soap solutions of low viscosities are made by mixing a finely divided soap such as aluminium stearate with a solvent such as toluole, benzole, naphtha or petroleum spirits, bubbling ammonia through or adding ammonia derivatives such as the stearate or hydroxide or an organic amine, and adding a polar organic solvent such as a lower aliphatic alcohol, cresylic acid or nitrobenzene. The solutions obtained in this way are useful as waterproofing or sizing agents for glass fibre, cotton, silk or other woven or matted fabrics. When incorporated into or modified with alkyd resin varnishes, coating compositions are obtained exhibiting improved electrical properties even after prolonged exposure to moisture.

C.

**Buoyant Rope: Production.** Fine Cotton Spinners' and Doublers' Association Ltd., Bleachers' Association Ltd. and W. Kershaw. B.P.557,442 of 16/4/1942:19/11/1943. A floatable rope consists solely of stranded, plaited or braided fibres enclosed within a waterproof sheath, the material of which does not impregnate the rope, the whole having a specific gravity of less than one. Preferably the floatable rope, in addition to being provided with a waterproof sheath, is formed of fibres which have been rendered water-repellent. A rope made of cellulosic fibres rendered by treatment with water-repellent substances so resistant to water as to prevent the interstitial cavities from being

filled with water by absorption will retain an apparent specific gravity of less than one for a period of several days. Such ropes are suitable for use as life lines, rocket lines and landing ropes. C.

**Coloured Yarns: Production.** Tom Welch (Disley). B.P.557,446 of 18/3/1942:22/11/1943. Coloured yarns are produced by passing yarn through a bath containing a dye capable of development by oxidation, thence between nip rollers, then in the wet state, or if preferred partially dried, passing it through a size-box containing size and an oxidising or fixing medium for the dye used whereby a colour is permanently formed on the yarn. With mordant dyes, the yarn is passed through a box containing the mordant dye, between nip rollers, then into a bath containing the mordant, and then through a size-box. In some instances the mordant may be added to the size. It is claimed that completely coloured yarns having the required degree of fastness and depth of shade can be produced by this method much more cheaply and quickly than by the usual dyeing process. C.

**Phenol-Aldehyde Resinous Condensates: Preparation.** British Thomson-Houston Co. Ltd. B.P.557,451 of 14/4/1942:22/11/1943 (Conv. 17/4/1941). A process for preparing phenol-aldehyde resinous condensates is carried out in two stages, (a) forming a solution of a phenol (5) and lignin (1), and reacting the solution with at least one aldehyde in an amount of from 0.5 to 0.95 mol. per mol. of phenol and under acid conditions, and (b) making the reaction mixture alkaline, and reacting it with additional aldehyde in an amount such that the total aldehyde content is of the order of 1.2 to 1.5 mols. aldehyde per mol. phenol. Further steps comprise neutralising the alkali and converting at least part of the free aldehyde present in the reaction mixture to a nitrogen-containing derivative thereof by the addition of a compound selected from the group consisting of ammonia, primary amines and secondary amines. A dispersing agent may be introduced into the alkaline reaction product before neutralising. Quick-curing resins of improved plasticity or flow are obtained which can be wet-mixed with fillers to produce moulding compositions suitable for the production of strong moulded products of good appearance. C.

**Ladder-resistant Knitted and Non-slip Woven Fabrics: Finishing.** H. E. Brew. B.P.557,459 of 15/5/1942:22/11/1943. A method of treating fabrics or yarns in which the yarns are composed of elements some only of which are potentially-adhesive and others of which are not potentially-adhesive, and of which the potentially-adhesive elements may be caused to adhere to each other without adhering to the other elements, and wherein the adhesion is brought about by a solvent treatment, is characterised by the use of potentially-adhesive elements of suitable cellulose derivatives, and by the selection of solvents and of an after-treatment with a swelling agent, to follow the solvent treatment, such that, during the after-treatment the potentially-adhesive elements are caused to increase in length, either merely to remove shrinkage produced by the solvent treatment or to give an excess of the original length, whilst the elements not potentially-adhesive do not increase in length. Tension may be imparted to the material during the solvent treatment. The amount of extension obtainable can be controlled within very wide limits, e.g. from 0 per cent. to 60 per cent. or more, by suitable adjustment of the concentration of the swelling agent solution and the temperature of treatment. Improvements are also effected in some of the physical properties, e.g. tensile strength, of the filaments. Suitable solvents are halogenated lower aliphatic hydrocarbons such as methylene and ethylene dichlorides. The swelling agents may be selected from the group comprising the aliphatic alcohols, fatty acids, ketones and esters, glycols, glycol ethers and esters, dioxane, di-acetone alcohol, chlorohydrins and mesityl oxide. The treatment may be applied to yarns and to fabrics, e.g. stockings, made from yarns comprising viscose and cellulose acetate filaments twisted together or spun yarns composed of mixtures of cellulose acetate fibres and cotton or other non-gelatinisable fibres (e.g. viscose fibres). C.

**Black Hexakisazo Dyes: Production.** G. F. Howard, M. Mendoza and Imperial Chemical Industries Ltd. B.P.557,460 of 18/5/1942:22/11/1943. Black hexakisazo dyes are made by coupling with one molecular proportion of 1:8-aminonaphthol-3:6-disulphonic acid, firstly in acid medium one molecular proportion of a diazotised primary arylamine and secondly in alkaline medium one molecular proportion of a tetrazotised *p*:*p'*-diaminodiphenyl compound,

or firstly in acid medium one molecular proportion of a tetrazotised *p*:*p*'diaminodiphenyl compound, and secondly in alkaline medium one molecular proportion of a diazotised primary arylamine, and then coupling two molecular proportions of the resulting diazodisazo compound with one molecular proportion of resorcin, *m*-phenylenediamine or *m*-aminophenol. The dyes can be readily applied to leather. C.

**Vat Dye Leuco-ester Salts: Printing.** Sandoz Ltd. (Freiburg, Switzerland). B.P.557,478 of 14/11/1941:23/11/1943 (Conv. 20/11/1940). A process for printing sulphuric acid leuco-ester alkali metal salts of vat dyes with the use of printing pastes containing oxidation media, organic acid-liberating media, oxidation catalysts, thickenings and water, is characterised in that organic bases volatile in steam and stable towards the oxidising media used in the absence of inorganic acids are added to the printing pastes and the colour printed, dried and developed by steaming. Suitable organic bases include mono-, di- and tri-ethanolamine, diethylenetriamine, aniline, pyridine and piperazine. C.

**Fire-resisting Varnish: Preparation.** H. Fielder. B.P.557,545 of 24/3/1942:25/11/1943. A non-inflammable, fire-resisting varnish for woodwork, paper and fabrics, is prepared by dissolving shellac and an alkali metal carbonate and/or borax, in water and then passing gaseous ammonia and chlorine through the solution until the resinous material is precipitated. The precipitated resinous material is dissolved in naphtha and mixed with a gum and ferrous sulphate dissolved in a solution containing an alkali metal carbonate neutralised by vinegar. The varnish may also contain an oil such as castor or linseed oil and an alkali metal silicate. C.

**Wool: Reducing Tendency to Felt and Shrink.** E. Clayton and W. A. Edwards. B.P.557,600 of 26/11/1943. A modification of the usual wet chlorination process, in which the wool is treated with a solution of sodium or calcium hypochlorite (less than pH 10.5) which is then gradually acidified by the addition of carbon dioxide, either as a saturated solution or as a solid. The acidification may be assisted by a hydrogen exchange synthetic resin. W.

**Slip-resistant Knitted and Woven Fabrics: Production.** H. E. Brew. B.P. 557,611 of 15/5/1942:26/11/1943. Knitted or woven fabrics which, by an adhesion treatment subsequent to knitting or weaving have the yarn united to itself at certain of the crossing points, are made from yarns which before knitting or weaving have been treated at some parts only with an activating agent and after knitting or weaving have been passed through a dispersion of rubber or a rubber-like substance which will respond to that agent so that a deposition of the rubber or the like will take place at the treated parts and thereby unite the yarn to itself, but only where two treated parts cross in contact. The activating agent may be a cation-active or an anion-active substance, in which case the dispersion will be one having particles of opposite charge, or it may be a coagulating agent. This method is particularly suitable for preventing slip in open-woven and slack-woven fabrics. C.

**Cellulose Acetate Crêpe Fabrics: Production.** British Celanese Ltd. B.P. 557,627 of 21/5/1942:29/11/1943 (Conv. 22/5/1941). In a process for the production of crêpe fabrics by subjecting to a hot aqueous scouring bath a fabric containing yarns of an organic derivative of cellulose which have been highly twisted in steam, the bath contains a substance of delayed solubility in water, e.g. soya bean protein, and a swelling agent for the cellulose derivative, e.g. pine oil or tetrahydronaphthalene. Scouring agents, such as sulphonated castor oil and sulphonated fatty alcohols, as well as varying amounts of alkaline agents such as soap, may also be present. C.

**Alkali Metal Chlorites: Production.** Mathieson Alkali Works. B.P.557,634 of 11/6/1942:29/11/1943 (Conv. 13/6/1941). Alkali metal chlorites are produced by absorbing chlorine dioxide in an aqueous solution containing hydrogen peroxide and the alkali metal bicarbonate. C.

**Dioxazine Dyes: Production.** E. I. Du Pont de Nemours & Co. B.P.557,789 of 1/6/1942:6/12/1943 (Conv. 14/5/1941). Dioxazine dyes are obtained by causing oleum, sulphuric acid or chlorosulphonic acid to act upon an NN'-disubstituted quinone diamine which is 1:4-benzoquinone substituted in the 3- and 6-positions by phenylamino groups and optionally in the 2- and

5-positions by halogen or alkyl, each of which phenyl groups carries a sulphonic acid group and, linked by means of an imino group, the residue of a benzazole compound (connected through the benzene ring), but has at least one position, ortho to the NH linkage with the quinone residue, free. After-treatment of the dyes with concentrated sulphuric acid and a small quantity of sodium chloride or hydrogen chloride enhances the exhausting properties of the dyes and results in greater tinctorial strength and washing fastness. Bright shades of blue and grey which are fast to washing are obtained on cotton. The dyes may also be applied to wool, silk, regenerated cellulose and nylon fibres. C.

**Pigmented Nitrocellulose Coating Compositions: Production.** E. I. Du Pont de Nemours & Co., C. A. Doran and C. R. De Bow. B.P.557,813 of 1/4/1942: 7/12/1943. A process for the production of pigmented nitrocellulose coating compositions free from grit and gel comprises filtering the compositions under pressure while having suspended therein a diatomaceous filter aid having an inherent permeability coefficient in the range of  $3.0 \times 10^{-5}$  to  $4.5 \times 10^{-5}$  c.g.s. units. The quantity of filter aid required normally represents 0.5 per cent. or less based upon the total weight of solution to be filtered. C.

**Pile Fabrics: Production.** Behr-Manning Corporation (Troy, N.Y., U.S.A.). B.P.557,820 of 3/6/1942:7/12/1943 (Conv. 4/6/1941). Flock particles are deposited in orientated relation upon a transfer apron having a thin layer of relatively weak adhesive associated therewith, sufficient to hold, temporarily, the flock particles in closely packed orientated relation thereon, in parallelism, normal to the surface of the apron. The free ends of the flock particles so supported are then pressed into a layer of adhesive carried by a backing sheet, the second adhesive having greater tenacity and strength than the first. The apron and the backing sheet are then moved apart and the flock particles stripped from the former are carried by the adhesive associated with the latter. The sheet so produced is then subjected to the usual drying and curing steps to produce a finished product. C.

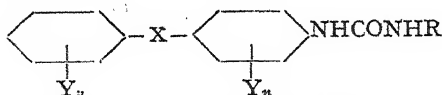
**Disazo Dyes: Production.** A. H. Knight, W. E. Stephen and Imperial Chemical Industries Ltd. B.P.557,842 of 6/5/1942:8/12/1943. Disazo dyes for wool and silk are made by diazotising a primary nitroamine of the benzene or naphthalene series, or an acidylaminoaniline, devoid of sulphone, sulphonamide and hydroxyl groups, coupling one molecular proportion in acid medium with a 1-amino-8-naphtholsulphonic acid, having the 2- and 7-positions free, to produce a monoazo compound, diazotising an arylamine of the general formula  $X.CO.NY.R.NH_2$  and coupling one molecular proportion in alkaline medium with the monoazo compound. In the general formula, R stands for a *m*- or *p*-phenylene residue which may carry simple azo dye substituents, e.g. methyl, methoxy or (except para to the  $NH_2$  group) sulphonic groups, but contains no aryloxy substituent, X stands for a monochloro- or mono-bromo-alkyl radical having not more than three carbon atoms and Y stands for hydrogen, alkyl ( $C_1$  to  $C_6$ ), cycloalkyl, aralkyl, alkoxyalkyl or aryl. C.

**Fabric Steaming Apparatus.** E. I. Du Pont de Nemours & Co. and C. N. Poesl. B.P.557,859 of 5/6/1942:8/12/1943. An apparatus for subjecting textile fabric to the action of a heating medium, e.g. steam, comprises, in combination, a number of tubes in side by side relationship, a distributor chamber for the heating medium enclosing a perforated tube co-acting with one of the tubes to form a conduit for the fabric, an inlet for supplying heating medium to the chamber, a baffle within the chamber for uniformly distributing the heating medium therein, and means for passing the fabric through each of the tubes in turn. The heating medium is directed on to the fabric in jet form and the heating medium and the fabric pass in counter-current through the tubes. C.

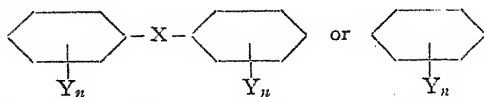
**Gelatin and Leuco Vat Dye Ester Salts: Application in Dyeing and Printing.** English Velvet and Cord Dyers' Association Ltd. and E. Holden. B.P.557,887 of 25/6/1942:9/12/1943. Fibres or fabrics are treated with gelatin, isinglass or glue, dried and heated, e.g. steamed at at least  $100^\circ C$ . for one hour, and then treated with ester salts of leuco vat dyes, e.g. the alkali salts of the sulphuric esters of leuco vat dyes. All-over or pattern effects may be obtained. In the latter case the gelatin may be applied to selected areas only or it may be applied to the whole fabric and removed or destroyed in selected areas by treatment with an oxidising agent. C.

**Guanidine Derivatives: Application in Basifying Cellulosic Materials.** Courtaulds Ltd., W. G. Cameron and T. H. Morton. B.P.557,909 of 9/3/1942: 10/12/1943. The dyeing properties of cellulosic textile materials are improved by incorporating in them a compound of an aliphatic aldehyde, e.g. formaldehyde or aldol, with a compound represented by the formula  $X.NH.C(NH).NYZ$ , where X is hydrogen or  $NH_2.C(NH)$ , Y is an alkyl, aralkyl or heterocyclic radical and may be substituted, and Z is hydrogen or an aralkyl, alkyl or heterocyclic radical, and in which the radical may be substituted, or the substituents Y and Z may together constitute a chain forming a ring with the N atom. Examples of suitable compounds of the given general formula include monoethanol biguanide, ethylene dibiguanide, monoethanol guanidine and ethylene diguanidine. After impregnation with the solution containing the aldehyde and the substituted biguanide or substituted guanidine, in which solution a preliminary condensation of the two compounds may have taken place, the textile materials are dried and heated to complete the reaction. The resulting basified fibres have a good affinity for acid dyes and when dyed a good fastness to light. C.

**Halogen-substituted Acylamino Sulphonic Acids: Mothproofing Agents.** H. Martin and Others (to J. R. Geigy A.-G.). U.S.P.2,311,062 of 16/2/1943 (through *Chem. Abs.*, 1943, 37, 4506). Numerous examples are given of the production of compounds of general formula:



(X=oxygen, sulphur or sulphur dioxide, Y=hydrogen, alkyl or a halogen,  $n=1$  or 2, and R represents



where Y,  $n$  and X have the defined meanings, there being at least one sulphonic acid group in at least one of the benzene nuclei and at least one halogen atom in at least one of these nuclei). W.

**Wool Materials: Shrinkproofing.** P. Arthur, Jr. (to E. I. Du Pont de Nemours & Co.). U.S.P.2,311,507 of 16/2/1943 (through *Chem. Abs.*, 1943, 37, 4582). The material is treated with a chlorinating agent which liberates hypochlorous acid in contact with water, e.g. 1,3-dichloro-5,5-dimethylhydantoin dissolved in a solvent, e.g. dioxane. W.

**Treatment of Papermakers' Felts and Blankets.** C. C. Gordon (to Albany Felt Co.). U.S.P.2,312,710 of 2/3/1943 (through *Chem. Abs.*, 1943, 37, 4900). For improving its durability and increasing its porosity to the passage of water and water vapour, a material which in normal use is subjected to comparatively high temperatures in the presence of moisture is immersed in a liquid, e.g. an emulsion of a metal soap and a wax which, when dry, will form a water-insoluble and water-repellent coating on the fibres, centrifuged and then dried. W.

**Protecting Animal Fibrous Materials Containing Keratin or Fibroin against Pests.** K. Lindner (to Chemopharm. G.m.b.H.). D.R.P.721,343 of 30/4/1942 (through *Chem. Abs.*, 1943, 37, 4912). The material is treated with aqueous, acid solutions of polymeric anhydrous phosphates containing bi- or multi-valent metal complexes. W.

**Paper Drier Felt.** H. N. Hill (to Asten-Hill Mfg. Co.). Canadian P.412,702 of 25/5/1943 (through *Chem. Abs.*, 1943, 37, 4572). The felt has a working face of interwoven warp and weft threads in one of which composite asbestos threads are incorporated. W.

**Felt Milling Machine: Stock Foot.** J. Dyson & Sons Pty. Ltd. Australian P.117,278 (through *Text. J. Australia*, 1943, 18, 308). A terraced casting is used on which to support individual blocks of wood to form the working surface of the hammer of the milling stocks. Individual blocks can be replaced when worn. W.



## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Cellulose Acetate Rayon: Production and Properties.** *Silk & Rayon*, 1943, 17, 240-2, 250, 368-370, 380, 502-6, 562-5, 684-5. A popular account is given of the development of cellulose acetate rayon and its dyeing, delustring, and processing, with particular reference to the influence of its plastic properties. C

**Cellulosic and Synthetic Rayons: Properties and Applications.** *Textile World*, 1943, 93, No. 9, 108-120. To assist in the selection of man-made fibres for specific purposes, large folding charts are provided that tabulate the following particulars, when known, for viscose, cuprammonium, and acetate rayons, nylons, Vinyon, Saran, Velon, Permalon, Aralac, and Fiberglas:—(1) Outline of method of manufacture, (2) tensile strength, (3) elongation at break, (4) elastic recovery, (5) linear change, (6) specific gravity, (7) moisture regain at 70° F. and 65 per cent. R.H., (8) total water absorbcency, (9) dielectric strength, (10) burning rate, (11) resistance to heat, (12) softening point, (13) effect of age, (14) effect of sunlight, (15) effect of acids, (16) effect of alkalis, (17) effect of other chemicals, (18) solubility in organic solvents, (19) affinity for dyes, (20) resistance to moths, (21) resistance to mildew, (22) types and sizes on the market, (23) uses, and (24) names of American producers and brand names. Another table gives some particulars about products that are still more or less in the experimental stage, such as animalised viscose rayon (Rayolanda), ethylcellulose, cellulose acetate-butyrate, soy bean fibre, peanut protein fibre, corn meal (zein) fibre, alginate fibre, synthetic rubber yarns, and plastic-coated yarns (Plexon). C.

**Cotton Fibres: Lateral Expansion Under Tension.** W. J. Lyons. *Textile Research*, 1943, 13, No. 11, 21-25. Experiments were carried out with Peruvian-type cotton of approximately  $1\frac{1}{4}$ -in. staple length. Flat bundles of parallel, single fibres were held at the ends with cellulose tape, over which in turn the jaws of clamps were fitted. The fibre bundles were held under tension in distilled water at loads just below the breaking point for periods of one-half to one hour. Cathetometric measurements indicated that under the conditions employed elongations of about 6 per cent. occurred. Similar bundles for control were merely soaked in water for equal periods. The bundles were then allowed to dry to equilibrium with the atmospheric conditions of the room (approximately 50 per cent. R.H. at 76° F.), the stretched bundles being held under tension so as to maintain the original stretch. Two tests were carried out with raw fibres and a third test with fibres which had been subjected to Soxhlet extraction with 95 per cent. ethanol, followed by soaking in 1 per cent. caustic soda and washing with water, very dilute sulphuric acid and water. In this third test, the stretched and unstretched bundles, after the treatment described above were dried in a vacuum oven at 80° C. for several hours and then conditioned. Cross-sections of all the fibre bundles were prepared. Photo-micrographs were enlarged and measurements of the cross-sectional areas within the fibre perimeters (whole sections) and in the lumens were made with a polar planimeter. Mean areas for each test are given, together with cell-wall cross-sectional areas (means of differences between whole-section and lumen areas of each fibre), standard errors, and significance evaluations. The data show a statistically-significant increase in the areas of the lumen and whole-fibre cross-sections as a result of wet stretching. The apparent changes in cell-wall areas due to stretching are statistically significant in two of the tests, but the changes are not consistent as to sign throughout the three tests. The data do not show any influence of the extraction or vacuum-drying in the third test. An explanation of these results is suggested which is based on the assumption that the principal effect of the tension is the partial removal of the series of collapsed regions (convolutions) from the fibre. The removal of these collapsed regions does not require the rotation of one end of the fibre with respect to the other. It is assumed that the extension due to longitudinal strains within the cell wall and the concomitant lateral contraction of the fibre are negligible, and that the reduction in area implied by the contraction is insufficient to offset the increase due to removal of the convolutions. C.

**Cotton Fibre: Testing.** K. L. Hertel. *Rayon Textile Monthly*, 1943, 24, 529-531, 603-604; *Address to Assoc. American Textile Technologists*, June 4, 1943, 14 pages. A review of new methods of testing cotton fibre, with special

reference to (1) the Fibrograph for length analysis, (2) the Arealometer for measuring specific surface and (3) the Pressley bundle-strength tester. C.

**Fibres: Effect of High Temperatures.** Z. A. Rogovin, V. A. Kargin and V. Smirnov. *Tekstil. Prom.*, 1941, No. 3, 40-42 (through *Chem. Zentr.*, 1942, ii, 1754 and *Chem. Abstr.*, 1943, 37, 6134<sup>a</sup>). Cotton fibres, cuprammonium rayon and viscose rayon were tested for tensile strength and elasticity at 20 and 120°, the latter temperature being of the order observed in the cord layers of automobile tyres after long running. Cotton fibres and cuprammonium rayon lost 30-40 per cent. of their tensile strength, whereas viscose rayon gained 5-7 per cent. Linen and ramie fibres behaved similarly to cotton fibres. The authors explain these reactions by the differences in the micro-structures of the fibres. C.

**Fibres: Structure and Properties.** E. Franz. *Die Chemie*, 1943, 56, 113-120, 132-136 (through *Chem. Abstr.*, 1943, 37, 6134<sup>a</sup>). A review covering the following subjects: cell units, chain molecules, dermatosome, swelling and resistance to wetting, screw-like fibrils, structure of the reprecipitated fibre, dermatosomes of staple fibre, determination of breaking strength in relation to fibre quality, and importance of transverse strength. C.

**Fibre Strength Units: Inter-conversion.** M. A. Sieminski. *Rayon Textile Monthly*, 1943, 24, 585-587. The relationships between grams breaking load per denier, pounds breaking load per square inch, fibre cross-sectional area, and fibre density are discussed and reduced to the following equations: (1) Pounds per sq. in. = gms. per den.  $\times \{ \text{density} \times 1.2791 \times 10^4 \}$  and (2) Grams per den. = lb. per sq. in.  $\times \{ 7.813 \times 10^{-5} \div \text{density} \}$ . A table shows tensile strengths in lb. per sq. in. corresponding with 1, 2, 3, 4 --- 9 gms. per den. for 15 values of density from 1.14 to 1.72 and for *d.* 2.56, the value for Fibreglas. The relationships are also plotted for *d.* 1.14, 1.30, 1.50, 1.72 and 2.56 and the graph also carries a table of average fibre densities for 25 sorts of natural and man-made fibres. C.

**Silk: Effect of Sodium Thiosulphate and Hydrogen Sulphite.** Ruth L. Johnson, Minnie E. Lichte and Rachel Edgar. *Iowa State Coll. J. Sci.*, 1942, 16, 411-419. Quantitative comparison has been made of the effect of 50-volume baths of water and of N-sodium thiosulphate in 10 hours at 40° C. on the residual weight, ash, nitrogen and wet strength of plain-woven wild-silk fibroin, silk fibroin, and iron-weighted, lead-weighted, tin-weighted, tin-lead-weighted, and zinc-weighted silks. Similar data are presented for the effect of 50-volume baths of 1.9232 N.-sodium hydrogen sulphite in 10 hours at 40° C., and for this treatment followed by 1 hour's steaming at 123.9° C., on silk fibroin and wild-silk fibroin. Only slight changes in the total nitrogen or wet strengths of the silks were produced by these treatments. The effect of sodium thiosulphate on the weight and ash of the weighted silks appeared anomalous. Sodium hydrogen sulphite, in 50-volume baths, 0.0500 to 2.0000 N., had no effect in 1 hour at 100° C. on the wet strength of either silk fibroin or wild-silk fibroin. C.

**Silk Cocoon and Raw Silk: Fluorescence.** G. N. Kukin. *Shelk*, 1940, 10, No. 9-10, 3-7 (through *Chem. Zentr.*, 1941, i, 2609 and *Chem. Abstr.*, 1943, 37, 6135<sup>a</sup>). The fluorescence of the cocoon and of the raw silk under the quartz lamp depends upon the pigment contained in the silk. A yellow fluorescence is produced by a yellow pigment which consists of xanthophyll and carotene. The green pigment is a bombycetin ( $C_{30}H_{18}O_7N$ ). In view of the fact that cocoons show different fluorescence the possibility exists of sorting them on this basis so that after spinning, a uniform, shadow-free fabric is obtained. C.

**Keratin Fibres: Reaction with Formaldehyde.** J. L. Stoves. *Trans. Faraday Soc.*, 1943, 39, 294-300. Determination of the load/extension curves of keratin fibres before and after boiling for 1 hour in 2 per cent. formaldehyde of pH 2-10 shows that at all pH values new linkages are formed, the greatest number, as estimated by the difference in behaviour of formaldehyde-treated and buffer-treated fibres, occurring in the neighbourhood of pH 7. At all pH values the amino groups of a proportion of the salt linkages take part in the reaction. Fibres treated with boiling solutions of 2 per cent. formic acid below pH 3 or above pH 9, develop linkages that are stable in boiling 5 per cent. sodium pyrosulphite for 1 hour. Fibres treated with boiling solutions of 2 per cent. formaldehyde of pH 3-8 contain relatively few of these linkages. Linkages formed by treatment for 1 hour with boiling 2 per cent. formaldehyde of pH 6 confer upon the fibre a partial immunity to attack by oxidising agents. No



increased resistance, however, is shown to hydrolysis by boiling water. The probable nature of the new linkages is discussed. C.

**Keratin Fibres: Reaction with Benzoquinone.** J. L. Stoves. *Trans. Faraday Soc.*, 1943, 39, 301-305. The effects of concentration, temperature, and pH on the reaction of *p*-benzoquinone with keratin fibres have been examined. Changes in the load/extension curves of fibres treated with aqueous solutions at the boil, indicate that the reaction leads to new linkages within the fibres, thereby increasing the resistance of keratin to decomposition by hydrolysis and by oxidation. With boiling solutions of 2 per cent. benzoquinone, maximum formation of new linkages occurs at pH 7. In more alkaline solutions extremely rapid polymerisation of the quinone greatly reduces the number of new linkages formed, the effect being particularly marked above pH 8. Suggestions are made as to the nature of the linkages as well as those formed by the action of benzoquinone on fibres whose cystine linkages have been reduced by pre-treatment with sodium pyrosulphite. C.

**Wool: Determination in Mixtures.** Lois W. Dale and Rachel Edgar. *Iowa State Coll. J. Sci.*, 1942, 16, 391-397. Methods for the determination of wool in mixtures with cellulosic materials based on extraction with (a) aluminium chloride or (b) 70 per cent. sulphuric acid have been compared by their effects on the weight, ash, total sulphur, and sulphate sulphur of the residual wool. The change in weight of wool in method (a) varied from -2.1 to +1.9 per cent. among 32 determinations; for 5 sets of 6 parallel determinations the means ranged from -1.2 to +1.0 per cent. The sulphate sulphur of the wool was removed by this method and the ash increased from  $0.10 \pm 0.01$  to  $0.43 \pm 0.15$  per cent. for one set and to  $1.04 \pm 0.11$  for another set of parallel determinations. The change in weight of wool by method (b) varied from -0.6 to +2.4 per cent. among 18 determinations; for 3 sets of 6 parallel determinations the means ranged from 0.4 to 1.4 per cent. The sulphate sulphur of the wool was increased from its original  $0.30 \pm 0.01$  to  $1.5 \pm 0.08$  per cent., the total sulphur from  $3.76 \pm 0.01$  to  $4.82 \pm 0.07$  for one set, and to  $5.04 \pm 0.15$  for another set of 6 parallel determinations although the ash was lowered from  $0.10 \pm 0.01$  to  $0.05 \pm 0.01$  per cent. With the proportion of wool at a maximum, these data indicate that method (b) is the better one. C.

**Uruguay: Wool Classification.** J. Molins, Jr. *Jornad. agron. vet. Univ. B. Aires*, 1939, 245-274 (through *Animal Breeding Abs.*, 1943, 11, 103). The present system of wool classification in Uruguay is described. Quality classes are briefly described and compared with the Bradford, French and German classes. The need is stressed for establishing a standard system which would bring Uruguay into line with other countries. The method suggested is based on fineness, and tables are shown giving the results of microscopic measurements of twelve samples from each of the ten classes. W.

**Wool Fibre Contour: Significance.** W. R. Lang. *Pastoral Rev.*, 1943, 53, 555-556. A figure is given showing the variety of cross section shapes of the more common textile fibres, and a graph illustrating the distribution of contour in a good merino 64s, compared with a crossbred 56s. Problems discussed are the contour of kemps, the influence of nutrition on contour, the effect of contour on spinning, and the effect of ellipticity in fibre thickness measurements, reference being made to the relevant literature. W.

**Textile and Chemical Microscopy.** J. G. Hare. *Text. J. Australia*, 1943, 18, 249-253. A lecture dealing with the microscope, its basic principles of operation, and its textile and chemical applications. Textile uses briefly surveyed are the determination of count in woollen and worsted spinning, the identification of fibres and fibre defects, the determination of faults in knitting and weaving, and fabric analysis. W.

**Structure of the Wool Fibre as Revealed by Electron Microscope.** C. W. Hock and H. F. McMurdie. *J. Res. Natl. Bur. Standards*, 1943, 31, 229-236; *Amer. Dyes. Rep.*, 1943, 32, 433-436, 451-454; *Text. Res.*, 1943, 13, 15-20. Over a wide range of magnifications the cortical cells showed a distinctly fibrous structure. Whereas with the optical microscope only fibrils were observed within the cortical cells, the higher resolving power of the electron microscope made possible the resolution of still finer micro-fibrils. The scale cells, on the other hand, showed little internal organisation. This difference in structure between the fibrous cortex and the non-fibrous or amorphous cuticle

is believed to be of fundamental importance in interpreting many of the properties of the fibres. W.

**Extra-uterine Aseptic Autolysis in the Skin of the Foetal Lamb.** W. J. Ellis. *Australia: J. Council Sci. Ind. Res.*, 1943, 16, 173-178. The mechanism which brings about the release of the wool fibre from the follicle during the early stages of post-mortem decomposition is being studied in connection with an investigation on the fundamental biochemical principles of fellmongering. A technique is described for obtaining sterile foetal lamb skin. *In vitro* studies of the rate and degree of aseptic autolysis of foetal lamb skin, assessed by estimation of soluble nitrogen formation, have revealed marked autolytic changes. W.

#### (B)—YARNS

**Cotton Thread: Use in Surgery.** S. A. Localio and J. W. Hinton. *Surg. Gynec. Obstet.*, 1941, 72, 615-618 (through *Brit. Chem. Physiol. Abstr.*, 1943, A III, 779). Tensile strengths of samples of silk, linen and cotton threads were determined as bought and after various sterilising procedures. Cotton should be boiled for 10-20 min. and used while wet. The tensile strength is decreased by autoclaving, or by drying after boiling. Cotton thread was successfully used in 50 major surgical operations. C.

**Loaded Cords: Deflection; Application of Operational Calculus.** L. A. Pipes. *J. Appl. Physics*, 1943, 14, 486-495. The differential equations governing the deflection of structural elements such as loaded cords and beams freely suspended or resting on an elastic foundation are solved by the Laplace transform or operational method. This method simplifies the analysis because it reduces the number of arbitrary constants to be determined and enables the effect of concentrated loads or applied couples to be determined directly. C.

**Cellulosic Materials: Moisture Content; Ballistic Galvanometer Determination.** E. Mankasch. *Zavod. Lab.*, 1939, 8, 471-474 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 314). The moisture content of cellulose or textiles affects their dielectric constant. This is measured by discharging a condenser filled with moist material through a ballistic galvanometer. C.

**Determination of Oil in Yarn.** L. Rytstein. *Chemist Analyst*, 1943, 32, 38 (through *Chem. Abs.*, 1943, 37, 4578). Place 250 ml. of ether or benzene in each of four 500-ml. wide-mouthed bottles. Take 6-12 g. of sample and dry 1 hr. at 50-60°. Cool in a desiccator and weigh to the nearest mg. Place the sample in the first bottle of solvent, stopper the bottle, shake and let stand 5 min. Remove and similarly give it a 5-min. wash in each of the other bottles. Squeeze out the solvent, dry for 1 hr., cool and weigh. W.

#### (C)—FABRICS

**Cloth Yardage Conversion Table.** Messrs. Block and Anderson Ltd. *Textile Weekly*, 1943, 32, 788. A table of conversion factors is provided for calculating square yardage from linear yardage. The table is for widths from half an inch to 35½ inches, in steps of half an inch, and the factors F range from 0.0139 to 0.9861. For widths above 36 inches the factors are 1 + F, and for widths above 72 inches 2 + F, and so on. C.

**Fire-resistant Duck: Testing.** J. R. Redmond. *Amer. Dyes. Rept.*, 1943, 32, 375-378. The writer reviews the United States Quartermaster specifications for fire-water-, weather- and mildew-resistant duck. The function of chlorinated paraffin in fire-resistant finishes for such materials is discussed, and stability tests of chlorinated paraffins which depend on measurements of hydrogen chloride evolution at 175° C. are briefly described. Substances having marked and slight accelerating actions on the decomposition, and substances which retard the decomposition of chlorinated paraffins at 175° C. are listed. The possibility of distinguishing between stable and unstable fire-resistant finishes by conducting stability tests on unstabilized chlorinated paraffin to which a sample of the fire-resistant fabric has been added is discussed and the results of a comparison of seven chemically fire-resistant finishes of actual commercial production are given. C.

**Sulphur-dyed Materials: Accelerated Ageing Tests.** T. R. Smith. *Amer. Dyes. Rept.*, 1943, 32, 380-384. Changes in strength of various sulphur-dyed fabric samples after accelerated ageing in electric ovens at various temperatures in an autoclave, and in the Fade-Ometer are tabulated. Details are

given of a standardized procedure for conducting accelerated ageing tests on sulphur-dyed fabrics in an oven at 135° C. The samples are heated in the oven for 6 hours and at the beginning of the second, third, fourth, fifth and sixth hours 20 c.c. of water are introduced into the oven for each cubic foot of oven capacity. A tentative procedure for conducting accelerated ageing tests in an autoclave is also described, and results obtained by this method are tabulated and briefly discussed. Reports are given of investigations of the loss in strength during storage and the fluidities of stored samples of yarn which had been dyed in raw stock with sulphur dyes. In general a direct correlation between loss in breaking strength and fluidity in rhes is noted. The marked degrading action of sulphur black is pointed out. Storage for five years did not materially affect the strength or state of degradation as determined by cuprammonium fluidity of samples dyed with sulphur pea green, light green, and medium dark green. C.

**Fabric Weight Determination Dies and Templates: Application.** L. Shapiro. *Textile World*, 1943, 93, No. 10, 87. To assist in the determination of cloth weight in oz. per square yard from the gram or grain weight of specimens the author has designed a set of square or circular dies and square templates for cutting the test specimens, of such dimensions that the gram or grain weights give the cloth weights directly (with occasional manipulation of the decimal point). The dimensions of these tools are tabulated. C.

**Webbing Breaking Load Testing Machine.** Riehle Testing Machine Division, American Machine and Metals, Inc. *Textile World*, 1943, 93, No. 10, 100. An illustration is given of a hydraulic testing machine in which loads are measured by gravity stress acting on a pendulum. It has a maximum capacity of 10,000 lb. and can accurately register loads as low as 50 lb. A special grip is used, capable of taking specimens up to 3 inches wide. The speed of traverse may be varied up to 12 inches per minute. C.

**Barré and Irregular Rayon Fabrics: Causes and Remedies.** H. E. Wenrich. *Rayon Textile Monthly*, 1943, 24, 191-192, 247-248, 303-304, 354-355, 419-420, 487-488, 535-6, 593-594. A general account is given of weft defects in cloth of the type described as "barré" and advice is given on their detection and cure. C.

**Cloth Defects: Points System for Grading.** R. E. Spear. *Textile World*, 1943, 93, No. 10, 78. To assist the cloth examiner in grading pieces, the writer suggests the following system of "points" for defects: (a) one end missing, 1 point per yard; (b) one double end missing, 2 points per yard; (c) one sley mark, 5 points; (d) one broken pick, 10 points; (e) one float half an inch long, 20 points. [The management could decide on points for other defects.] Grade A cloth, on this basis, would score 0 points, B 1-30 points, C 31-64 points and D 65 points or more. Grade B cloth might be corrected in dyeing and finishing but Grades C and D should be regarded as imperfect and the weaver notified. C.

**Crease-resisting Spun Rayon Fabrics: Properties.** Tootal Broadhurst Lee Co. Ltd. *Rayon Textile Monthly*, 1943, 24, 597-598. The advantages of applying the "crease-resisting" process to spun rayon fabrics are briefly reviewed. Data are tabulated to show that the wet strength and resistance to shrinking in the wash are also improved. Dyed "Tebilized" fabrics are much faster to washing and somewhat faster to light than fabrics not crease-proofed. C.

**Jacquard Fabric Defects: Description.** T. Nelson. *Textile World*, 1943, 93, No. 10, 82-83. Illustrated descriptions are given of the following defects and causes are suggested: (1) Broken pick, (2) double pick, (3) floats, (4) "ends out" in stripes, (5) "ends out" on every repeat of the pattern, (6) ends weaving under the fabric in every repeat of the pattern, (7) weft floating on the face of the fabric, (8) warp ends floating on the face of the fabric, (9) ends drawn wrongly in the healds, and (10) broken pattern. C.

**Rayon, Silk and Nylon Stockings: Wearing Qualities.** Hazel M. Fletcher. *Rayon Textile Monthly*, 1943, 24, 537-538, 601-602. The wearing qualities of some new brands of viscose and cuprammonium stockings, reinforced with cotton, have been compared with those of silk and nylon stockings as reported in a previous investigation. The following data are tabulated: (I) Price, weight, shrinkage and yarn and knitting particulars of the four brands of rayon hose. (II) Bursting strengths at knee, leg, ankle, heel, toe and welt of nylon, silk and

rayon hose, with (III) analysis of variance. (IV) Bursting strength on knee and leg of worn nylon, silk and rayon hose, with (V) analysis of variance. (VI) Hours worn, fading test index numbers, and numbers of launderings, with (VII) and (VIII) analyses of variance. The results are held to demonstrate the superiority of the nylon stockings; they lasted longer, and were washed more times than the rayon stockings, and these were better than the silk stockings, except in appearance. C.

**Textile Materials: Measurement of Extension at Break; Use of "Effective Gauge Length."** W. J. Hamburger and E. R. Kaswell. *Rayon Textile Monthly*, 1943, 24, 579-584. The authors discuss the indeterminate nature of the length of specimen that suffers extension in a breaking load test, due to the variable "jaw penetration effect" of different types of grip on different types of material. Thus, with the capstan type of jaw where the specimen runs along the diameter between two semi-circular pieces and then right round the circumference before passing on to the other jaw, the actual fixed point of the specimen might be where it leaves the grip, or some stretching might occur anywhere in the gripped portion right round the circle and up to the starting point. To arrive at a definite value for the denominator in the "per cent. extension" equation the authors take advantage of the fact that the load/extension graph is usually a straight line from 80 per cent. of the breaking load on to the final rupture. They propose, therefore, to measure the breaking load on one specimen, mark off a length  $L$  between the jaws on another specimen, load the specimen to 90 per cent. of the breaking load with the autographic extension recorder in place, measure the extension  $\Delta L$  by means of a cathetometer, note on the record chart the increase  $\Delta S_0$  in the distance between the jaws,  $S$ , and calculate a basic reference length, called the "Effective gauge length," from the fraction  $L\Delta S_0/\Delta L$ . The load/extension test is then carried out as usual and the per cent. true extension at break calculated by dividing the increase in jaw separation at break as read on the autographic record by the "effective gauge length." Some examples of the value of the artifice include measurements on bleached cotton sheeting with capstan and flat jaws, unbleached cotton sheeting, nylon braid, 10's/8 cotton cord and nylon yarn, that is, materials with widely different frictional properties. C.

**Union Fabrics: Milling Shrinkage.** C. S. Whewell, M. A. M. Eid, N. Kokmen and M. C. Lui. *J. Soc. Dyers & Col.*, 1943, 59, 234-240. Tests with fabrics having cotton warps and wefts composed of blends of various percentages of wool and chlorinated wool showed that the presence of even small amounts of untreated wool caused considerable increases in milling shrinkage. The milling shrinkage of wool-cellulose acetate rayon fabrics was less than that of all-wool fabrics. The milling shrinkage of wool-casein fibre fabrics was greater than that of all-wool fabrics. When tests were made on fabrics with cotton warps and wefts containing various amounts of wool mixed with casein fibre, it was found that fabrics containing only 25 per cent. wool in the weft shrink as well as all-wool. There was, however, no indication that fabrics containing only casein fibre in the weft are capable of shrinking during milling. Ardil, a fibre prepared from pea-nut protein, behaved similarly to casein fibre. In fabrics having a cotton warp and worsted spun weft, the incorporation of Fibro or Rayolanda X in the weft resulted in a reduction of shrinking power. The effect of Rayolanda X was much less than that of Fibro, it being possible to introduce as much as 75 per cent. Rayolanda X without greatly reducing the shrinking power. Among fabrics in which warp and weft yarns were worsted-spun from the same blends, the shrinkage of a 50/50 wool-Rayolanda X fabric was much greater than that of the corresponding all-wool fabric, and the shrinkage of a 50/50 wool-Fibro fabric was slightly greater than that of the all-wool. In tests of woollen spun fabrics with warp and weft yarns made from the same blends, the wool-Rayolanda X fabrics showed milling shrinkage powers superior to those of wool-Fibro fabrics, but the shrinkage of the union fabrics did not exceed that of the all-wool material. The difference between the effects of Fibro and Rayolanda X on milling capacity is discussed and shown to be related to the elastic properties of the fibres. C.

**Waterproof Fabrics: Testing.** A. F. Lagov. *Tekstil. Prom.*, 1941, No. 3, 51 (through *Chem. Zentr.*, 1942, ii, 1755 and *Chem. Abstr.*, 1943, 37, 6136<sup>6</sup>). Two forms of apparatus for testing the waterproofness of tent materials in a mill are described. The first consists of a framed glass plate upon which is

placed a dry filter paper which has been steeped in sodium carbonate solution. The material to be tested is placed upon the filter paper. Water containing a little phenolphthalein is then dropped from a pipette upon the material from a height of 1 m. The other apparatus, a so-called "Penetrometer," consists of a container tightly covered with the material to be tested which is connected on both sides to two tubes. The operation of the Penetrometer is described. C.

**Starched Fabrics: Stiffness.** See Section 7.

(D)—OTHER MATERIALS

**Kraft Pulp: Comparison.** O. Kress and F. T. Ratliffe. *Paper Trade J.*, 1943, 117, TAPPI, 187-191. A complete physical evaluation is described of a typical kraft pulp from southern (U.S.) yellow pine and a spruce kraft pulp produced in the north. The southern pulp hydrates and develops "slowness" in the beater much faster than does the northern pulp. The southern sheet has lower bursting and tensile strengths than the northern sheet, but a higher tearing strength. The differences are not due to differences in chemical constituents, nor to variations in the ultimate fibre strength, but to differences in the fibre-to-fibre bonding strength. C.

**Pulp: Fibres per Gram.** J. H. Graff. *Paper Trade J.*, 1943, 117, TAPPI, 181-187. A method of determining the number of fibres in a given amount of pulp involves dyeing a weighed sample, preparing a dilute suspension, transferring 5 ml. of the suspension to a slide, allowing to dry, and counting the number of fibres on the slide under the microscope. Results are given for various bleached and unbleached pulps. Considerable variation in the number of fibres per gram is observed. Curves are given showing fibre length distributions by weight, and fibre counts, weights and dimensional data for the pulps are tabulated. A definite relationship is found between the number of fibres per gram of pulp and the weighted average fibre length of fibres longer than 0.1 mm. As a result of this relationship, the total fibre length and area of a given amount of pulp can be calculated from ordinary fibre dimensional data without counting the fibres. C.

**High-strength Plastics: Physical Properties.** H. Sang and P. M. Field. *Modern Plastics*, 1943, 21, No. 2, 107-109, 142. Tables are given showing the physical properties of high-strength materials comprising paper or glass-and-cotton fabric laminated with a phenol-formaldehyde or melamine resin and a felted asbestos-fibre base impregnated with phenol-formaldehyde resin. Data for various commercial laminates and an aluminium alloy are given for comparison. The specific flexural values of the high-strength materials compare favourably with those of the aluminium alloy and the specific tensile strength of the paper and glass-and-cotton materials approaches that of the aluminium alloy. The specific bearing strength is lower and the specific compressive strength much lower than that of the aluminium alloy. The plastic materials show inferior buckling resistance, and strengths at 160° F. are lower than at room temperature by amounts varying up to about 48 per cent. C.

**Plastics: Mechanical Properties.** S. L. Smith. *Engineer*, 1943, 176, 491-2, 511-2, 529-530. A useful summary of information on the mechanical properties of (1) Moulded plastics, (2) Laminated sheet with (a) paper, (b) fabric filling, (3) Moulded plastics containing fibre, (4) Plastic-bonded wood, (5) Reinforced plastics as structural materials, and (6) Plastics for bearings. The routine testing of laminated sheets is also reviewed under tensile, extensometer, compression, shear, impact, and creep and fatigue tests. C.

**Rubber: Dynamic Properties.** C. O. Harris. *J. Appl. Mechanics*, 1942, 9, A 129 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstracts*, 1943, Sheet B4:140). Determinations have been made of damping coefficients and dynamic moduli of elasticity for cylinders in compression, and specimens in shear, the rubber being bonded to steel. Details are given of the apparatus, procedure and results. The results show that for the rubber stock tested when bonded to steel the damping decreases with increase of frequency and with increase of static strain. The dynamic modulus is slightly larger than the static modulus and is not affected by change of frequency. The dynamic modulus increases with static strain for the cylinders, and decreases for the shear specimens. For cylinders in compression, both damping and modulus are dependent upon the ratio of cylinder diameter to length. C.

**Paper: Optical Heterogeneity.** A. King and J. Levitin. *J. Soc. Chem. Ind.*, 1943, 62, 170-173. Apparatus for the measurement of the optical heterogeneity or "look-through" of paper consists essentially of an illuminating system, a differential system of two photo-electric cells, and a device for moving a strip of paper and a photographic plate in front of beams of light. Records are obtained of the variation in the transmission of light by a paper strip with distance along the strip. Diagrams and details of the construction and operation of the apparatus are given, together with optical heterogeneity curves obtained for different types of paper. The relations of optical heterogeneity to total opacity, thickness, density, permeability to liquids, and other properties of paper are discussed. C.

**Evaluation of the Modified Renard and Kerr Tests for the Determination of Peanut Oil.** S. T. Voorhies and S. T. Bauer. *Oil & Soap*, 1943, 20, 175-178. Methods are surveyed for determining peanut oil in a mixture of oils. Samples containing known amounts of peanut oil in cottonseed, soybean, hydrogenated cottonseed, and olive oils were prepared and analysed for arachidic acid content by the Renard procedure as described in the "Official and Tentative Methods of Analysis" of the Association of Official Agricultural Chemists; the percentage of peanut oil was calculated as 20 times the total weight of the arachidic acid fraction. Mixtures of peanut with cottonseed and soybean oils were analysed by the Thomas and Yu modification of Kerr's method (*J. Amer. Chem. Soc.*, 1923, 45, 113). The results of the analyses show that neither method is sufficiently accurate to warrant its use for the quantitative determination of peanut oil in vegetable oil mixtures, the reasons for this being discussed. W.

## 7—LAUNDERING AND DRY CLEANING

### (A)—CLEANING

**Alkaline Washing Compounds: Germicidal Properties.** C. R. Arnold and M. Levine. *Iowa State Coll. J. Sci.*, 1942, 16, 519-538. Equations are derived for the relationship between temperature, concentration of caustic solution, and period of exposure to effect germicidal actions equivalent to those stipulated in various American standards for bottle washing. The general equation for the period of exposure (or killing time) is  $\log \theta = K - a \log C - bt$ , where  $\theta$  is time in minutes,  $C$  is concentration of caustic soda expressed as percentage,  $t$  is temperature,  $a$  and  $b$  are coefficients determined experimentally and constant for a given germicide, and  $K$  is a constant characteristic of the resistance of a hypothetical organism stipulated by a given standard. For caustic soda as the germicide,  $a$  was found to be 1.79120, and  $b$  is 0.05630 when temperature is expressed in °C. and 0.03129 if temperature is expressed in °F. Values of  $K$  are given. Tables showing the concentration of caustic soda required to produce an equivalent germicidal effect for a stipulated temperature and period of exposure (killing time) are presented for each of the standards considered. The equations employed are derived from that for killing time, the general equation being  $\log C = k' - 0.55828 \log \theta - 0.01747t$  where  $C$  is concentration of caustic soda in percentage,  $\theta$  is the period of exposure or killing time in minutes,  $t$  is the temperature in °F., and  $k'$  is a constant for any stipulated standard under consideration. The differences in the  $K$  values of any two standards is the logarithm of their respective killing times (for a stipulated temperature and concentration of caustic soda), while the difference in the  $k'$  values is the logarithm of the ratio of the respective concentrations of caustic soda (for a given temperature and killing time) which will produce equivalent germicidal effects. C.

**Stiffened Fabrics: Stiffness.** E. R. Kaswell. *Textile Research*, 1943, 13, No. 11, 26-31. Strips of standard grade shirting material were included with batches of shirts in a starching treatment in a laundry wheel and stiffness determinations were carried out on the starched strips with a Gurley stiffness meter. Data showing the effect of starch concentration and weight of material treated on stiffness are tabulated and curves of weight of goods/stiffness (at constant starch concentration) and starch concentration/stiffness (at constant weight) are given. The results show that, for a constant weight of goods, the use of additional starch causes marked increase in stiffness. At constant starch concentration, the addition of more material causes very little reduction in



stiffness. Therefore, in routine starching, the normal variation in weight of material warrants only a negligible change in the amount of starch used. Variation of the amount of starch used in direct proportion to the weight of the material will result in great changes in stiffness. Where the variation in weight is great, the proper amount of starch for any weight may be determined from graphs of the type obtained in these experiments. C.

**Dry Cleaning as a Means of Delousing Garments.** J. I. Staubly and A. C. Lloyd. *Soap*, 1943, 19, No. 8, 94-96. Immersion in Stoddard solvent is fatal to lice, but not to their eggs; a normal tumbling process, which involves a temperature of 160° F. for not less than 10 min., kills both eggs and lice. Thus any dry cleaning plant equipped with a hot air tumbler destroys body lice and their eggs, and the garments are not damaged in the process. W.

**Dry Cleaning: Record Production by Unorthodox Technique.** P. C. Trimble. *Starchroom Ldy. J.*, 1943, August, 44, 46, 50, 52. The technique used by a certain American plant results in an average of 64 per cent. of the work requiring only a single dry cleaning process and most of the remaining 36 per cent. being spotted in the machine. The cleaning is a heavy-moisture operation, 2½ ounces of moisture per pound of fabric being generally used, less on knitted woollens and silk crêpes. Shrinkage is controlled by loose packing of the hydro and by running it only one minute at full speed, also by running the tumbler cold for the first five minutes. Rejected garments are spotted quickly and liberally with acid S.F.A. solution and re-cleaned. Sizing is carried out in the cleaning bath. This cleaner processes furs with synthetic solvent to which wax has been added to hold the colours and improve the finish. A production record of 44 dresses per operator hour has been reached in this plant. La.

## 8—BUILDING AND ENGINEERING

(A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Chlorinated Rubber Acid-resistant Paints: Application.** Detel Products Ltd. *Silk & Rayon*, 1943, 17, 796. "Detel" paints are based on a solution of a chlorinated rubber in an organic solvent. When spread by a brush they leave behind tenacious, non-inflammable films that are highly resistant to atmospheric or chemical corrosion. For painting iron and steel, the variety "D.M.U." is used; this contains finely divided zinc, affording anodic protection. The chlorinated rubber is also marketed as a paste and as sheeting, for lining tanks, etc. C.

**Electroplating: Developments.** O. P. Watts. *Electrochem. Soc. Preprint*, 1943, 84, No. 9, 75-78. The author describes the following investigations: (1) Rainbow plating, or the production of brilliant multi-coloured electroplates from ammonium molybdate solutions. (2) The co-deposition of nickel and copper as Monel. Results obtained with carbonate-citrate, sulphate-citrate and acetate-citrate baths containing sodium cyanide are tabulated. Bright hard alloy deposits were obtained. (3) Attempts to deposit chromium with either copper or iron were unsuccessful. C.

**Iron Plating Solution: Composition and Application.** W. B. Stoddard, Jr. *Electrochem. Soc. Preprint*, 1943, 84, No. 5, 38-45. A report is given of investigations of conditions for the deposition of ductile iron from chloride solutions and of the development of an improved plating solution containing 200-500 g./l.  $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ , 3.5 g./l.  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ , and about 1 g./l. Gardinol WA powder. The manganese chloride is used to decrease the grain size and broaden the physical operating conditions, and the wetting agent serves to prevent pitting. The temperature range over which this solution will produce heavy, fine-grained ductile deposits runs from 150° F. to 220° F. (70-105° C.). The pH range is 1.5-2.5, with an optimum at about 2.0 as determined with a glass electrode. The cathode current density range broadens as the temperature increases. At 160° F. (70° C.) the maximum current density is of the order of 50 amp./sq. ft. (5.4 amp./dm.<sup>2</sup>). In uncontaminated solutions the current efficiency is above 95 per cent. No ventilation is necessary. Many materials will cause embrittlement and gassing in this solution. Notes are given on the effects of various impurities. C.

**Starch and Resin Adhesives: Use in Production of Fibreboard.** J. E. Killinger. *Paper Trade J.*, 1943, 117, TAPPI, 201-206. The development of adhesives for use in the production of weatherproof laminated fibreboard is

reviewed. Advantages and limitations of starch-asphalt adhesives are pointed out. The use of combinations of urea-formaldehyde resins and starch has made possible the production of V boxboard which shows scarcely any de-lamination after 24 hours immersion in water at 80° F. The reactions of the resins in such glues and the influence of the types of resins and starches are discussed. Starches exhibiting high gel-forming properties are best in pasting and weather-resistant qualities. The pH should be above 5.2. Copper equipment should not be used. Resin concentrations of the order of 7-10 per cent., based on the weight of starch, appear to be adequate. The sodium salts of chlorinated phenols are generally effective as preserving agents. Clay may be incorporated in starch-resin glues to decrease penetration. Notes are given on pasting operations. C.

**Copper: Atmospheric Corrosion.** J. H. Wilkinson and W. S. Patterson. *J. Soc. Chem. Ind.*, 1943, 62, 167-170. The formation of protective coatings on copper during atmospheric corrosion in the presence of particles of sodium chloride, ammonium chloride, and ammonium sulphate has been investigated under controlled conditions of temperature and humidity. Below 80 per cent. R.H. no serious corrosion occurs, but at higher humidities protective coatings are formed in the presence of each of the three electrolytes. In the presence of sodium chloride, the formation of red cuprous oxide, even at R.H. 60 per cent., is particularly noteworthy. At higher humidities basic copper chloride is formed and some of the cuprous oxide is oxidised to cupric oxide. In the presence of the ammonium salts it is probable that complex copper salts are formed. C.

**Timbers: Properties.** R. W. Hess. *Mechanical Engineering*, 1943, 65, 653-656, 660. Problems affecting the use of wood in aircraft are discussed, and the need for improvements in wood quality and for the study of wood properties and structural-design requirements is pointed out. Tables are given showing 35 timbers rated according to the ratio to the specific gravity of (1) elastic modulus, (2) modulus of rupture, (3) fibre stress in bending, (4) compressive strength, (5) fibre stress in compression, (6) shear strength, and (7) compression perpendicular to grain. Ratings are briefly discussed in relation to uses. C.

**Mill Floors: Cleaning.** R. W. Mitchell. *Textile World*, 1943, 93, No. 10, 86. Practical hints are given on mopping up spilt oil or grease, the use of alkaline salts assisted by wetting agents for washing concrete or work floors, and the choice of soap and solvent cleaners for linoleum, cork, tiled and similar floors. C.

#### (C)—STEAM RAISING AND POWER SUPPLY

**Lancashire Boilers; Heat Transmission in —.** G. E. Foxwell. *J. Inst. Fuel*, 1943, 16, 168-173 (through *Brit. Chem. Physiol. Abstr.*, 1943, B I, 386). An analysis of the mode of heat transmission in Lancashire boilers indicates that not only is radiation the most important factor in the combustion chamber, but that in the flues, contrary to popular conception, gas radiation and radiation from the internal surfaces of the brickwork setting are far more important than convection. This conclusion confirms the desirability of the radiating gases, carbon dioxide and water vapour, and the necessity for minimising the excess of air. C.

#### (D)—POWER TRANSMISSION

**Lubricating Oils: Testing.** G. W. Waters and E. C. Larson. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 550-559. A detailed description is given of a corrosion and stability testing apparatus in which a bearing surface in a heated reaction vessel containing the oil to be tested is subjected to the action of a felt wiping pad which is mounted on a rotor. A current of air is passed through the reaction chamber and the oil is subjected to vigorous stirring. Recommended conditions of test are specified. Corrosion is determined by the loss in weight of the bearing, and the deterioration of the oil is determined by measurements of changes in neutralisation number, saponification number, viscosity, naphtha-insolubles, etc. Results obtained in tests on various oils are compared with the results of engine tests. It is shown that the correlation is sufficiently good to justify the use of the corrosion and stability test for the preliminary evaluation of lubricants. C.



**(E)—TRANSPORT**

**May Hosiery Mills Yarn Supply Conveyors.** S. Schwartz. *Textile World*, 1943, 93, No. 10, 92-93. An illustrated account is given of a system of yarn supply at a mill with 150 operatives producing 50,000 doz. pairs of stockings weekly. The cones of yarn are carried on spindles attached to the side bars of an endless roller chain. When a knitter anticipates the need for more yarn she writes particulars on a requisition form and places it on the conveyor at her nearest station, from which it travels to the supply room. The person in charge places the required yarn on the conveyor and presses a button corresponding to the station in question. Automatically, the yarn travels on its way and a sound and a light signal herald its arrival. The system has saved about 20 minutes of each knitter's time per day. C.

**(F)—LIGHTING**

**Textile Factories: Lighting.** *Textile Mercury & Argus*, 1943, 109, 608-612. A general review of the advantages of better lighting in such processes as beaming, with special reference to fluorescent lamps. C.

**(G)—HEATING, VENTILATION AND HUMIDIFICATION**

**High-temperature Water Heating Systems: Application in the Dyehouse.** P. L. Geiringer. *Textile World*, 1943, 93, No. 9, 100-101. The advantages of employing water at temperatures of 290-400° F. instead of steam for heating dye liquors and other solutions used in bleaching and finishing are explained. The feed pipes may be quite narrow and savings of 20-30 per cent. are possible. C.

**Air Conditioning Plant: Developments.** B. C. Oldham and G. E. Clifford. *Engineering*, 1943, 156, 465-466. A broad review is given of the development of air conditioning, with special reference to systems that involve refrigeration. C.

**Bridge Controlled Relay Circuit for Humidity Control.** H. L. Andrews. *Rev. Sci. Instruments*, 1943, 14, 276. In a bridge controlled relay circuit for the automatic control of humidity, a lithium chloride hygrometer cell of the type described by Dunmore forms one arm of a Wheatstone bridge which is fed with 110 volts a.c. through a transformer whose low voltage winding is connected across the tube filaments. The output of the bridge is fed into a 6V6 operating as a linear amplifier which in turn energizes the grid of an 884 grid-controlled gas discharge tube. The plate of this gas tube is supplied with 110 volts a.c. This tube can conduct only on alternate half-cycles but a 5,000-ohm d.c. relay shunted with 0.5 microfarad operates without chattering. With the relay operating a spray system it has been possible to maintain room humidity within limits of  $\pm 0.5$  per cent. C.

**(I)—WASTE DISPOSAL**

**Waste Treatment at Yale Woollen Mills.** E. F. Eldridge. *Michigan Eng. Expt. Sta. Bull.*, 1942, No. 96, 3-18 (through *Chem. Abs.*, 1943, 37, 3865). Pilot plant studies of wastes from a woollen mill indicate that a dosage of 1 lb. calcium oxide and 3 lb. ferric chloride per 1,000 gal. of waste gives an average removal of suspended solids of 83.4 per cent. and an average biochemical oxygen demand removal of 72.4 per cent. Equalization is essential for efficient removal of both. The use of a magnetite filter is suggested to hold back the light floc noticeable at times. Sludge characteristics and pH data are presented. Recommendations and a design for a full-scale treatment plant are given. W.

**PATENTS**

**Atmospheric Moisture Indicating Apparatus.** British Thomson-Houston Co. Ltd., H. R. Ruff and L. J. Davies. B.P. 557,613 of 3/5/1940: 29/11/1943. An apparatus for producing an indication of the presence of a pre-determined amount of moisture in a gaseous medium, and operating in response to the change of electrical resistance between two spaced conductors as a result of the deposition of moisture particles on an insulating path between them, coincident with the change of resistance causing an indication to be given, the energy input into an electrical heater positioned in heating relationship to the path is increased to cause the evaporation of the particles and the return of the path to the non-indicating condition, the energy input into the heating element being thereupon reduced whereby the apparatus is more rapidly returned to a condition in which a fresh indication can be given. The spaced conductors are preferably metal bands on the outer surface of the envelope of an electric lamp

which constitutes the heater. The change of resistance is utilised to cause to be rendered conductive a grid-controlled gas-filled rectifier the current flow through which is utilised for energising the heater and operating an indicator. C.

**Moisture Droplet Detecting Device.** British Thomson-Houston Co. Ltd., H. R. Ruff and M. G. Clarke. B.P.557,614 of 28/8/1941:29/11/1943. An electrically insulating gap device for the detection of moisture droplets comprises at least two strips of sheets of electric conducting material spaced apart by an electrically insulating material having a thickness of the same order as that of the diameter of the droplets to be detected, the strips and insulating material being clamped between side checks and exposed to the atmosphere at their edges, an electrical heater being provided in thermal conductive relationship with the assembled insulating material, conductors and side checks. Preferably, the edges of the side checks and insulated strips are arranged to form a surface on which the moisture droplets can deposit, the edges of the side checks being finished by grinding or other suitable treatment. The device is maintained at an elevated temperature so that moisture present in the form of vapour will not deposit on and render conducting the gap. C.

**Remote Recording Moisture Indicating Apparatus.** British Thomson-Houston Co. Ltd., H. R. Ruff and R. F. Weston. B.P.557,615 of 28/8/1941:29/11/1943. Apparatus for the remote indication of the fact that a normally insulating gap has become conductive by the deposition of conductive particles between the electrodes comprises means responsive to a diminution in the insulation resistance of the gap for changing the bias on the grid of a thermionic valve thereby to change its conductivity and to cause the emission of high frequency oscillations of a different frequency which (when received on a suitable receiver) serve as an indication of the deposition of the particles on the gap. When used in conjunction with the gap device of B.P.557,614, on the emission of a high-frequency signal a high potential is impressed across the electrodes of the gap to disperse the droplets causing the breakdown of the insulation of the gap. C.

## 9—PURE SCIENCE

**Distilled Water Purity Meter.** Fisher Scientific Co. *Rev. Sci. Instruments*, 1943, 14, 279. The Barnstead Purity Meter indicates the purity of distilled water by measuring its electrical conductivity. Conductivity depends on ionization and most impurities in distilled water are ionized. The instrument does not discriminate among the many ions that may be present but is calibrated for direct reading in parts per million of sodium chloride. The method of operation is outlined. C.

**Aluminium and Iron: Determination of Small Amounts in Water.** N. Stratford and P. F. Wyatt. *Analyst*, 1943, 68, 319-324. A method is described for the complete separation and determination of Fe in waters, by solvent extraction as thiocyanate, in such a way that Al can be determined readily in the extracted solution. Details are also given of modified aurintricarboxylate and haematoxylin methods by means of which it is possible to determine 0.1-0.5 p.p.m. of Al to an accuracy of  $\pm 0.05$  p.p.m., or 0.01-0.10 p.p.m. of Al to an accuracy of within  $\pm 0.01$  p.p.m., provided that the amount of Fe originally present does not exceed about ten times that of the Al content. The modified haematoxylin method is rather more convenient and slightly more sensitive than the modified aurintricarboxylate method. Both methods can be used to give an accurate colorimetric measure of the total Fe and Al content (expressed as Al) of a water sample. Some typical results are given. C.

**Carbon Disulphide Vapour: Photometric Determination.** S. Silverman. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 592-595. In a photo-electric method of determining carbon disulphide in the atmosphere, the transmissions of light from a mercury lamp by similar columns of contaminated and uncontaminated air are compared. Carbon disulphide has an intense absorption in the region of 3100 Å. None of the other contaminating vapours from the viscose process absorbs in this spectral region. Photographs, diagrams and details of the design and operation of the apparatus are given. The range of concentrations covered is 2 to 200 p.p.m. by volume. The time required for an individual determination is 1 min. or less, and the accuracy is 1 p.p.m. The apparatus may be run continuously with a resolving power of 5 to 10 sec. and an accuracy of 4 p.p.m. A typical calibration curve and a chart showing the time variation

of the carbon disulphide concentration in a poorly ventilated mixing room are reproduced. C.

**Cellulose Formaldehyde Compounds: Analysis for Formaldehyde.** C. L. Hoffpauir, G. W. Buckaloo and J. D. Guthrie. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 605-606. Combined formaldehyde in organic compounds and in cellulose formals can be determined by heating with 12N. sulphuric acid for 2 hours at 90° C., and then adding fuchsin-sulphite reagent to the solution, leaving for 2-2½ hours, and measuring the transmission in the region 550-585 mμ with a photo-electric colorimeter. Experimental details and some typical results are given. Results obtained in the analysis of cellulose formals by this colorimetric method agree well with results obtained by the gravimetric method using dimedone precipitation. C.

**Organic Solvent Vapours: Determination.** J. *Ind. Hyg. & Toxicol.*, 1943, 25, 172-174 (through *Bull. Hygiene*, 1943, 18, 840). In a modified silica gel method for the determination of organic solvent vapours in air, the adsorbed solvent is extracted from the gel by another solvent which will not cause subsequent interference and the amount of organic solvent is then determined by any suitable method of quantitative analysis. This method has been used for the determination of carbon tetrachloride, which is extracted by ethyl alcohol, decomposed by alcoholic potassium hydroxide, and titrated as chloride. In a long series of experiments in which the amount of carbon tetrachloride was known, the percentages detected ranged from 91 to 99. C.

**Caustic Soda: Recovery.** L. Grunberg. *Ind. Chemist*, 1943, 19, 628-632. Losses in the recovery of caustic soda in causticizing operations result from incomplete conversion and from the formation of insoluble double salts through the interaction of calcium and sodium carbonates. In a study of these losses solutions of sodium carbonate of different concentrations were treated with 10 per cent. excess solid calcium hydroxide at 80° C. for two hours and the progress of the causticizing reaction was checked by titration by the double indicator method. Tables and graphs are given showing the variation in per cent. conversion and per cent. total recovery with the original sodium carbonate concentration, per cent. conversion being defined as (NaOH equivalent in final solution) × 100 / (Na<sub>2</sub>CO<sub>3</sub> equivalent in original solution) and per cent. total recovery as (NaOH and Na<sub>2</sub>CO<sub>3</sub> equivalent in final solution) × 100 / (Na<sub>2</sub>CO<sub>3</sub> equivalent in original solution). The data show that the total losses and the losses in conversion are rather high for greater concentrations if a single recovery run is considered. Losses that occur when the solution has been subjected several times to the recovery process are studied. After a large number of runs the replacements (amounts of caustic soda to be added in order to make up the alkalinity) are very much smaller than after a single run. In every case in which continuous recovery of caustic soda is intended, the conditions are more favourable than the results taken from the equilibrium curves would indicate at first sight. C.

**Linden Wood: Fractionation and Enzymic Degradation.** T. Ploetz. *Ber. Deut. Chem. Ges.*, 1940, 73, 790-794 (through *Brit. Chem. Physiol. Abstr.*, 1943, A II, 315). When linden wood (*Tilia tomentosa*) is digested for 14 days with cupri-ethylenediamine, about 34 per cent. of a residue (A) is obtained. Acid precipitates about 42 per cent. from the solution; about 24 per cent. remains soluble. The components of lower methoxyl content are preferentially dissolved. A fraction containing 75 per cent. of pentosan had 3.28 per cent. of methoxyl, indicating that the methoxyl of the sugars occurs mainly in the pentosans. The residue (A) is rapidly attacked by snake venom; up to 50 per cent. degradation the loss in weight is accounted for by the sugar in solution; thereafter discrepancies occur. The limit degradation amounts to 58.5 per cent. The insoluble material (B) is then a 1:1-lignin-sugar complex, containing only a little pentose. Treatment of (B) with cupri-ethyldiamine leaves 8.8 per cent. of residue, containing 78.9 per cent. of lignin; acid precipitates from the solution a small amount of material which is degraded enzymically to the 1:1 complex, which does not now contain pentose. Treating the solution from (B) with acid gives a product which suffers 62.1 per cent. of enzymic degradation, the insoluble portion then containing 39 per cent. of lignin. Repetition on this insoluble portion of the two degradative procedures gives an insoluble material containing 53.8 per cent. of lignin, i.e. the 1:1 complex. C.

**Powders: Fineness Measurement by Air Permeability.** R. L. Blaine. *A.S.T.M. Bulletin*, 1943, No. 123, p. 51-55. Details are given of an apparatus resembling a U-tube viscometer for measuring the rate of flow of air through granular materials as a means of measuring fineness. The theory of the instrument (based on Carman's equation relating specific surface to permeability) is developed and exemplified by results on samples of cement. C.

**Sliding Solids: External Friction.** A. Gemant. *J. Appl. Physics*, 1943, 14, 456-464. The fundamental mechanism of external friction between sliding solids, which is based on the geometric irregularity of macroscopically plane surfaces, is discussed. Experimental results showing the dependence of the friction coefficient on pressure, speed and temperature are reviewed and shown to reveal the plastic deformation of surface irregularities as a complicating factor during sliding. Observations of slip-stick motion and of traces of soft metals left upon harder metals sliding against them are also discussed and it is pointed out that the observations indicate abrasion as another complicating factor in external friction. C.

**Sliding Solids: External Friction; Technical Applications.** A. Gemant. *J. Applied Physics*, 1943, 14, 510-521. The following technical applications of external friction of solids are discussed: (1) belt drives, (2) clutches, (3) brakes, (4) vibration dampers such as the Lanchester damper, (5) self-excited vibrations such as shaft whipping and sound production in a violin, and (6) grinding and crushing. In most cases a brief outline of the mechanism of operation is given, and in the first three cases principles of design and chief types of construction are described and necessary numerical data on friction coefficients are given. C.

**Large Molecules: Electron Diffraction.** K. H. Storks. *Bell Laboratories Record*, 1943, 21, 390-393 (through *Chem. Abstr.*, 1943, 37, 5300<sup>b</sup>). Electron diffraction is used to study films thinner than the total length of a fully extended macromolecular chain of such chain polymers as polyethylene sebacate, and guttapercha. When stretched, the fully extended macromolecules pack into long straw-like bundles. In guttapercha, films one-millionth of an inch thick indicate that the macromolecules fold back and forth like an accordion, accounting for the ability to recover after stretching. C.

**Electrometric pH Meters: Application.** H. T. S. Britton. *Endeavour*, 1943, 2, 148-153. The underlying principles of electrometric pH measurement are concisely reviewed, some instruments are illustrated, and some applications in pure inorganic chemistry are described. C.

**Wood: Hydrolysis in Acetic Acid Solution.** F. Schütz. *Zellwolle, Kunstseide, Seide*, 1942, 47, 8-9 (through *Chem. Abstr.*, 1943, 37, 6123<sup>d</sup>). Hydrochloric acid, hydrochloric acid buffered with ammonium chloride, hydroxylamine hydrochloride, and Al, Zn and Mg chlorides are suitable catalysts. The latter compounds have the advantage over the free acid that the pH remains the same over the whole boiling period. As the pH depends on the degree of the hydrolytic degradation it becomes thus possible to obtain a wide variety of hydrolysis products. The use of magnesium chloride and acetic acid on various woods produces alkali-soluble lignin having phenol character as well as approximately two-thirds of the hemi-celluloses in the form of monomeric sugars. These lignins are chlorine-free and correspond in their composition to alkali-insoluble acid lignins and cuprammonium lignin. They are a mixture of heavy and light soluble particles differing presumably in molecular size. The magnesium chloride method is suitable for the preparation of lignins from various fibre raw materials. C.

**Glycine: Rôle in Protein Structure.** H. Neurath. *J. Amer. Chem. Soc.*, 1943, 65, 2039-2041. It is pointed out that in proteins internal rotation of polypeptide chains is restricted by the space requirements of side chains and that the presence of glycine residues may confer a considerable degree of flexibility and internal rotation, since, wherever a glycine residue occurs, a hydrogen atom takes the place of a more complex residue. The proper distribution of glycine residues would permit any combination of side chains which, otherwise, would have to be excluded because of steric hindrance. The concept of internal rotation due to glycine might account for the selective orientation of side chains in monomolecular protein films and obviate the necessity for concluding that certain proteins, such as keratin and myosin consist of an even number of

polar and non-polar side chains, arranged alternately along the main chains. Silk fibroin is devoid of a diffraction period longer than  $2 \times 3.5$  A. along the fibre axis, although a repeating pattern at about  $16 \times 3.5$  A. would have to be expected if the residues in this protein, of which about 44 per cent. are glycine and 25 per cent. alanine, were distributed in a regular fashion. This could be explained by ascribing to glycine a position, determined by a specific stereochemical function, in preference to the position required by a periodical arrangement of amino acid residues. Whilst glycine thus facilitates folding of polypeptide chains, more reactive amino acid residues probably determine the mode of folding by mutual interaction. This hypothesis rests on the assumption that glycine is a natural constituent of all proteins. C.

**Oil Films: Influence on Evaporation of Water.** R. W. Powell. *Trans. Faraday Soc.*, 1943, 39, 311-318. Measurements have been made of the rate of loss of weight of water contained in glass vessels and covered by surface films of oil of different thicknesses. The results show that unimolecular oil films produce only a little reduction in the rate of evaporation from an underlying water surface, but that the reduction due to thicker films of oil can become appreciable. Measurements were made with oil thicknesses ranging up to 2.5 cm. The rate of loss/oil thickness curves passed through minima at thicknesses of the order of 0.6 to 1.0 cm. It is shown that the reduction in the rate of evaporation becomes relatively greater as the air velocity is increased, and that the order of the effect can be estimated from a knowledge of the diffusion coefficients of water vapour through air and oil. C.

**Amyloses: Colloid Chemistry.** M. Samec. *Kolloid Z.*, 1942, 100, 106-110 (through *Chem. Abstr.*, 1943, 37, 5901<sup>2</sup>). The rôle of colloid chemistry in increasing the knowledge of the structure and properties of starch and particularly of the amyloses is discussed. Some colloid-chemical studies on amyloses which will broaden the present knowledge of the starches are enumerated: (1) rôle of hydrogen bonding in hindering acetylation; (2) eventual change in (physical) form, due to external influences; (3) relation, according to Alsberg, between swelling and molecular structure; (4) ultramicroscopy; (5) variation in structure and iodine colour; (6) hydration phenomena; (7) aggregation and its effect on the iodine colour; (8) aggregation and bonding; (9) iodine colour and degree of dispersion; (10) optical rotation; (11) electric phenomena; (12) protective colloid effects; (13) combination of amyloses with cellulose; (14) stability of the lamellae; (15) change in viscosity due to external influences; (16) coagulation due to concentration; (17) form of state of the solid amylose-water system; (18) spinnability; (19) ageing phenomena; (20) ageing and enzymic hindrance; (21) X-ray spectrum; (22) cold coagulation; (23) cornification; and (24) crystallisation. C.

**Gelatin Films: Swelling.** R. E. Liesegang. *Kolloid Z.*, 1943, 102, 17-22 (through *Chem. Abstr.*, 1943, 37, 5901<sup>4</sup>). Nitrocellulose-lacquered paper was coated with gelatin solutions to form films which when dry were stripped therefrom. The swelling of these films in cold water depended on film thickness. C.

**Cellulose Acetate Fractions: Osmotic Pressure and Viscosity.** A. Bartovics and H. Mark. *J. Amer. Chem. Soc.*, 1943, 65, 1901-1905. The specific viscosities of cellulose acetate fractions having 38.6 per cent. acetyl, 0.06 per cent. ash content and a melting point of  $250^\circ$ , were determined at various concentrations (up to 0.5 volume per cent. of the solute) in acetone. The slopes of the curves of  $\eta_{sp}/c_v$  against  $c_v$  can be represented by a single constant  $k'=0.70$ . The osmotic pressures of the same fractions were measured at various concentrations (up to 0.8 weight per cent. of the solute). The slopes of the curves of  $\pi/c_2$  against  $c_2$  ( $c_2$ =concentration of solute in gm. per c.c. of solution) can, within reasonable limits, be represented by one single constant  $\mu=0.43$ . The relation between intrinsic viscosity and molecular weight is discussed and shown to be represented by the equation  $[\eta]=KM^a$ , where  $K=1.04 \times 10^{-2}$  and  $a=0.67$ . C.

**Nitrocellulose Solutions: Viscosity.** H. A. Wannon. *Kolloid Z.*, 1943, 102, 29-34 (through *Chem. Abstr.*, 1943, 37, 5900<sup>8</sup>). Nitration of cellulose was performed in phosphoric acid solutions. Degree of polymerisation was determined osmotically. For the same degree of polymerisation, the viscosity increases with extent of esterification (determined by the nitrogen content) which is more important in this respect than chain length. C.

**Magnesium Stearate: Thixotropic Behaviour.** B. S. Kandelaki. *Izvestiya Gruzinskogo Ind. Inst. Kirova*, 1940, No. 13, 109-120 (through *Khim. Referat. Zhur.*, 1941, 4, No. 6, 18 and *Chem. Abstr.*, 1943, 37, 5900<sup>8</sup>). Thixotropic transformations of Mg stearate solutions in benzene and cooling curves of 5-30 per cent. solutions are reported. The break in the cooling curves corresponds with the transformation of sol into gel. The optimum temperature of thixotropic transformation rises linearly with the concentration of the solution. C.

**Thixotropy: Theory.** W. von Engelhardt. *Kolloid Z.*, 1943, 102, 217-232 (through *Chem. Abstr.*, 1943, 37, 5900<sup>8</sup>). A relation between the Winkler number, the time for a thixotropic gel (kaolinite) to set, and the hardness test when quartz is scratched by silicon carbide in a liquid medium is shown for a number of liquids. Attractive and repulsive forces between particles are treated like ions of ionic lattices in which the total potential is a minimum at a definite distance interval of two particles. Effects of grain size and distribution are considered. Polarity of the medium is an important factor as well as shape. Flat particles have a greater tendency than spheres to produce a thixotropic gel. C.

**Compounds Related to Lignin: Ultra-violet Absorption Spectra.** R. F. Patterson and H. Hibbert. *J. Amer. Chem. Soc.*, 1943, 65, 1862-1869. The ultra-violet absorption spectra are recorded for pyrocatechol and pyrogallol-1:3-dimethyl ether, their methyl ethers and various derivatives in which a carbon side chain is substituted *para* to the phenolic hydroxyl. Compounds containing the vanilloyl or veratroyl group have three absorption bands in the ultra-violet region at approximately 980 *f*, 1070 *f* and 1300 *f*, syringoyl derivatives have bands at 980 *f* and 1300 *f* and trimethoxybenzoyl derivatives at 1070 *f* and 1300 *f*. (*f*=frequency in Fresnel units.) The effect of side chain substitution is briefly discussed. C.

**Ethanol Lignins: Ultra-violet Absorption Spectra.** R. F. Patterson and H. Hibbert. *J. Amer. Chem. Soc.*, 1943, 65, 1869-1873. A report is given of an investigation of the ultra-violet absorption spectra of a series of ethanol lignins obtained by the ethanolysis of spruce and maple woods. Comparisons are made with the spectra of compounds of known structure and the conclusion is drawn that the spectra of amorphous lignins can be explained satisfactorily on the assumption that they are derived from lignin precursors of the types exemplified by hydroxy derivatives of 1-(4-hydroxy-3-methoxyphenyl)-1-propanone and 1-(4-hydroxy-3:5-dimethoxyphenyl)-1-propanone. The absorption curves indicate that lignin is aromatic in nature. The evidence suggests that a carbonyl group or an ethylenic double bond is present in conjugation with the aromatic nucleus to some at present unknown extent. C.

**Aminco-Scott Glossmeter.** American Instrument Co. *J. Optical Soc. America*, 1943, 33, 554. The Aminco-Scott Glossmeter consists essentially of four main components: (1) goniophotometer; (2) reference plate and sample holder; (3) control and measuring unit; (4) galvanometer. The instrument operates on 110-120 volts 60 cycles (controlled frequency) single-phase a.c., and is unaffected by fluctuations in line voltage. It can be used for measuring high, medium and low gloss (from zero to 100 per cent.) of plane surfaces of materials over  $2\frac{1}{2} \times 3$  in. in size. A complete gloss curve of a high gloss sample can be obtained in approximately 30 minutes. C.

**Colour: Constancy.** H. Helson. *J. Optical Soc. America*, 1943, 33, 555-567. The tendency for colours and forms to remain constant, within limits, in spite of changes in illumination and orientation is discussed, and conditions and characteristics of film and surface colours, the rôle of the illuminant, and tolerances for changes in illumination and in the dimensions of colours are examined in relation to colour constancy. Experimental studies of the effects of brightness of stimulus, reflectance of background, and depth of shadow on lightness compensation are discussed. As a result of work with non-selective samples in chromatic illuminations on various backgrounds the following principle of colour conversion has been formulated and applies equally well to phenomena of compensation: in every viewing situation there is established an adaptation level such that samples having reflectances above adaptation reflectance take the hue of the illuminant, whilst samples below take the hue of the after-image complementary to the illuminant; samples near adaptation reflectance are either achromatic or very low in saturation. Background reflectance, by virtue of the large area of background and because background



furnishes the border for all samples in the field, is the most important single factor in the visual field determining adaptation reflectance which is to be regarded as a weighted mean reflectance of all parts of the visual scene. It is shown that this principle gives a reasonable explanation of the interdependence of adaptation, contrast, and compensation and the many questions raised by them. Contours, boundaries and tri-dimensional effects are studied. C.

**Colour Concepts.** Committee on Colorimetry, Optical Society of America. *J. Optical Soc. America*, 1943, 33, 544-554. A study is made of the concept of colour under the following headings: (1) colour: characteristics of light, (2) colour sensation: an element of experience, (3) modes of appearance, (4) psychological concepts, (5) psychophysical concepts, (6) physical and physiological concepts, (7) inter-relations of concepts related to colour, (8) consciousness: subjective aspect of cortical activity, (9) psychophysics, and (10) classification of concepts related to colour into (1) psychological, (2) physical and (3) psychophysical. A chart is given showing the correspondence between attributes of radiant energy, light, visual sensation and perception. C.

**Colour Measurement: Progress.** L. A. Jones. *J. Optical Soc. America*, 1943, 33, 534-543. The historical background and evolution of the Colorimetry Report which is to be published by the Optical Society of America are reviewed, particular attention being given to the reasons for the adoption of the psychophysical definition of colour. C.

**Colour Vision: Farnsworth-Munsell 100-Hue and Dichotomous Tests.** D. Farnsworth. *J. Optical Soc. America*, 1943, 33, 568-578. Details are given of the F-M 100-hue test, which is a simple exploratory technique for the laboratory examination of colour vision. It is based on the fact that colour anomaly can be represented as a simple fore-shortening of the Uniform Chromaticity Scale Diagram of normal vision and the various kinds classed according to the axis of greatest reduction in colour perception. Tests have shown that there is also a class of people who have low discrimination without imbalance of colour perception. The 100-hue test yields data from which other tests can be constructed; one of these, a screening or sampling test which dichotomizes subjects into two discrete classes, is described. Some typical results are shown. Critical scores for code-colour discrimination for particular occupational requirements can be determined. C.

**Cellulose Acetate and Poly-methyl Methacrylate Films: Fast and Slow Extension.** R. N. Haward. *Trans. Faraday Soc.*, 1943, 39, 267-280. In a theoretical discussion it is suggested that the work taken up by any material under impact may be governed either by the rate at which deformation can take place or by the amount of possible deformation. Experimental results on the slow extension and breaking of cellulose acetate and poly-methyl methacrylate films are presented, and an investigation of the change in properties of cellulose acetate films with temperature is reported. Temperature changes during adiabatic extension appear to be not so large as to alter fundamentally the character of the deformation. Tentative deductions are made regarding the possible behaviour of the materials under impact conditions and these are compared with the results of some simple impact tests. When the various factors considered in the theoretical discussion are taken into account, apparent contradictions between slow and fast extensions can be eliminated. It is pointed out that the work absorption of different materials under changing conditions of testing varies both relatively and absolutely, and the validity of a generalised impact strength is questioned. A more precise formulation of shock conditions appears desirable. C.

**Soaps: X-Ray Diffraction.** J. W. McBain, O. E. A. Bolduan and S. Ross. *J. Amer. Chem. Soc.*, 1943, 65, 1873-1876. Fibre and powder photographs of sodium laurate, palmitate and stearate are discussed and the dimensions of unit cells of the  $\beta$  and a "hydrated  $\gamma$ " form of the monoclinic soaps at room temperature calculated. It is pointed out that  $\alpha$ ,  $\beta$  and  $\gamma$  forms differ primarily in long spacings, but likewise to a less extent in the lines corresponding to side spacings. C.

**Sampling Inspection Plan for Continuous Production.** H. F. Dodge. *Ann. Math. Statistics*, 1943, 14, 264-279. A sampling plan is presented for controlling the quality of the products of a factory when the articles are produced in a continuous stream and on inspection immediately after manufacture are classed

as "defective" or "non-defective." The quality is assumed to be statistically "in control." The procedure is as follows: (a) At the outset, inspect 100 per cent. of the units consecutively as produced until  $i$  successive units are non-defective. (b) Then continue to inspect, one at a time as produced, a fraction  $f$  of the units produced until one defective unit is found. Then repeat procedure (a), and so on. It is envisaged that all defective units that are discovered will be corrected or replaced by good units. For a given fraction of ingoing defective units,  $p$ , and values of  $f$  and  $i$ , there will be an "average outgoing quality" (AOQ) measured as the fraction defective in the units passed forward; and at some value of  $p$  the AOQ will reach a maximum—the "average outgoing quality limit" (AOQL). Curves are given for determining values of  $f$  and  $i$  to give specified values of the AOQL, and the relative efficiency of various sampling schemes is discussed. C.

**Measuring Proteolytic Activity: Gelatin Viscosity Reduction Method.** F. G. Lennox. *Australia: J. Council Sci. Ind. Res.*, 1943, 16, 155-166. The gelatinase activities of trypsin, papain, euphorbain, and a mould protease are measured over a wide range of concentrations, using the digestion flask viscometer and a "remote control inverter." Time for a given change in viscosity bears no constant relationship to concentration over a wide range of enzyme concentrations, and although the relationship between viscosity after 10 min. incubation at 40° C. and enzyme concentration always approximates to a hyperbolic form, the shapes of the curves for different enzymes and for different samples of the same enzyme diverge appreciably at high concentrations. Thus the activity cannot be expressed in terms of equivalent enzyme concentration by reference to some simple equation or calibration curve, and it is therefore proposed to report it as reduction in viscosity of the enzyme-gelatin mixture after 10 min. incubation at 40° C., expressed as a fraction of the initial viscosity. Estimation of the amino and carboxyl groups in enzyme-gelatin mixtures shows that chemical splitting can be detected within 1-2 min. of adding the enzyme. After 8 min. at 40° C., by which time certain highly active enzyme solutions have reduced the viscosity almost to the minimum value, approximately 3 peptide bonds are split per 10,000 g. gelatin. Assuming a molecular weight for gelatin of 35,000, the average molecular weight of the resultant polypeptides would be approx. 2,800, which corresponds to chains of about 28 amino acid residues. W.

**Australian-grown Papain.** W. J. Ellis and F. G. Lennox. *Australia: J. Council Sci. Ind. Res.*, 1943, 16, 166-172. After a short survey of the properties and uses of papain, an examination is made of Australian papain, details being given of the distribution of the papaw in Australia. Samples of papain prepared by drying latex from green fruit of the papaw, *Carica papaya*, grown in Queensland, possess marked gelatinase and rennase activity. Juice pressed from the skins of the fruit possesses higher rennase activity than that obtained from the flesh. Seed extract has no measurable activity. The activity of the latex is of the same order for papain from different species of tree and for preparations dried with acetone, alcohol, or in the air. W.

**Map of the Natural Amino Acids.** G. Toennies. *Science*, 1943, 97, 492-493 (through *Chem. Abs.*, 1943, 37, 4413). A chart is presented as a visual aid to workers concerned with the protein-building  $\alpha$ -amino acids. The chart is explained. W.

**Entropy.** "Vacuum." *Steam Engineer*, 1943, 13, 51-58. Various relations concerned with the Carnot cycle are considered and the emergence of entropy as a useful function is explained. Temperature-entropy charts and total heat entropy charts are illustrated and described to show the practical usefulness of the function to engineers. La.

## 10—ECONOMICS

**Cotton Weaving Costs: Controlled Margins and Allowances.** *Textile Weekly*, 1943, 32, 954-955. Revised margins and allowances under the Cotton Control Order No. 48, of December 22nd, are reproduced in a series of tables. C.

**Textile Wholesale Prices, November, 1943.** *Bd. Trade J.*, 1943, 149, 461. The wholesale price index numbers for November are Cotton 136.2, Wool 182.8, Other textiles 131.2, All articles 162.7 (1930=100). C.



**"Let the People have Wool."** F. E. Ackerman. *Wool Rec.*, 1943, 64, 719, 722. Details are given of the activities of the American Wool Council, especially of the distribution in American of its booklet on the care of wool apparel, and of its broadcasting activities. W.

**Wool: Competition from Synthetic Fibres.** E. B. Lord. *Wool Rec.*, 1943, 64, 754-755. W.

**Wool Textile Industry: Future.** D. R. H. Williams. *Wool Rec.*, 1943, 64, 757-758. Address before the Bradford Textile Society, dealing firstly with the principles and practice of boiler house management in relation to fuel economy, and secondly with the structure of the wool textile industry in relation to probable post-war conditions. A plea is made for the support of research, and for more appreciation of modern developments in textile machinery. W.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Aerosol-OT: Toxicity.** A. E. Benaglia, E. J. Robinson, E. Utley and M. A. Cleverdon. *J. Ind. Hyg. & Toxicol.*, 1943, 25, 175-180 (through *Bull. Hygiene*, 1943, 18, 834-844; *Chem. Abstr.*, 1943, 37, 6032<sup>a</sup>). (1) Fifty rats had the wetting agent Aerosol-OT (dioctyl ester of sodium sulphosuccinate) in their food in doses up to 0.87 g. per kg. per day, and all survived a 6-months' experimental period. Diarrhoea was occasionally noticed in the animals on the higher doses. Neither the total red cell, total white cell, nor differential counts of rats was affected by the continued administration, but in a special experiment a very transient shift in the differential count was observed, the neutrophils being increased at the expense of the lymphocytes. Three dogs receiving 0.1 g. per kg., and three with 0.25 g. per kg. of Aerosol-OT daily in their food remained in good health for six months. Three monkeys survived for six months the daily administration by stomach tube of 0.125 g. per kg. of the substance. It appears that Aerosol-OT is rather irritating to the stomach, for in dogs and monkeys doses greater than 0.25 g. per kg. and 0.125 g. per kg., respectively, generally resulted in prompt regurgitation. Five rabbits were given 0.5 g. per kg. of Aerosol-OT daily by stomach tube, and of these two survived the full six months' period. The only signs of toxicity in those that died were anorexia and severe diarrhoea. Diarrhoea was also observed in the survivors from time to time. In none of the animals which survived the full experimental period did gross or microscopic examination reveal any significant lesions. (2) No toxic symptoms have been encountered in workmen who have handled the wetting agent daily over periods of years. C.

**Benzole: Danger to Health.** H. Seyfried. *Arch. f. Gewerbepath. u. Gewerbehyg.*, 1942, 11, 588-618 (through *Bull. Hygiene*, 1943, 18, 841-842). The solvent power of benzole for fats makes for rapid permeation into the blood stream and concentration in the lipoid-rich brain and bone marrow, and hence its narcotic and dyshaemopoietic action. The volatility accounts for its rapid entrance by the respiratory route. A report is given of investigations of cases at the Second Medical Clinic of Vienna. The criteria of blood variations due to benzole injury are specified. Women over 40 were found to be most susceptible with both short and long exposure, and fat people more susceptible than thin people. Details are given of subjective symptoms which, though slight, are frequent and manifold in character and bear no relation to blood findings. The importance of ascorbic acid and lactoflavin in maintaining normal metabolism and their increased requirement in exposure to benzole is emphasized. Disturbance of the haemopoietic system is discussed. Therapeutic measures include administration of liver, iron, calcium and lactoflavin (in the form of whole milk and yeast) and administration of vitamin C. Periodic medical examination has proved useful in detecting early signs of poisoning; for persons who have been exposed for years with no sign of injury a six-monthly examination is probably sufficient.

**Hydrocarbons: Toxicity.** W. F. Oettingen. *Yale J. Biol. & Med.*, 1942, 15, 167-184 (through *Bull. Hygiene*, 1943, 18, 840-841). The gaseous paraffins have narcotic properties of a very low order and little significance in industrial exposure. The narcotic action of olefines increases with molecular weight and boiling point. The irritant action of olefines is less marked than that of paraffins. When applied to the intact skin they cause, less readily, oedema of

the superficial layers of the skin and inflammatory reactions. The higher olefines also exert an injurious effect on the liver. The aromatic hydrocarbons are more dangerous than the aliphatic hydrocarbons. They are absorbed from all mucous membranes and through the intact skin. In addition to irritation of the mucous membranes of the upper respiratory tract early symptoms of moderate benzene poisoning are excitement, headache, vertigo, nausea, vomiting and burning sensations in the epigastric region. The maximum allowable concentration for eight hours' exposure daily is at present accepted as 100 p.p.m. Toluene causes more marked irritation than benzene, and its toxicity and narcotic action are also more marked. Xylene causes more marked irritation of the mucous membranes and skin than do the lower homologues and its narcotic action is slightly greater than that of toluene. C.

**Industrial Dermatitis: Prevention.** Committee on Occupational Dermatoses, American Medical Association. *J. Amer. Med. Ass.*, 1943, 122, 370-375 (through *Bull. Hygiene*, 1943, 18, 843). The importance of correct recognition of the industrial origin of a case of dermatitis is emphasized. The patch test is useful but is responsible for many errors. A substance which produces a definite irritation on the skin of a majority of persons, not previously sensitized to that substance, is called a primary irritant. A sensitizing agent increases the tissue-capacity to react to exposure. Certain criteria for diagnosis are detailed. Sensitization dermatitis is less frequent than dermatitis due to primary irritants but it is likely to be more severe and protracted, with recurrence and prolonged disability. Superficial fungous infections are of importance in the predisposition to occupational dermatitis, and should be watched for on the hands and feet. Vitamin therapy, particularly with vitamin C, may be of value. Dry skins should not be exposed to solvents and degreasers, and blondes should not work with photosensitizing agents. An intact, clean, normal skin is the best protection against dermatitis. Protective creams are of some value; mixtures of hydrous wool fat and castor oil are useful for protection against solvents and degreasing agents, and boric acid for protection against alkalis. Formulae are given. Sometimes more cases of dermatitis result from improper cleansing than from the industrial exposure; an industrial cleanser for general use should consist of a superfatted neutral toilet soap containing a wetting agent. Drying and cracking of the skin results from the defatting action of cutting oils used in the turning of metals; it predisposes to dermatitis from sources other than the oil. The commonest occupational skin disorder is folliculitis following upon plugging of hair follicles with oil, grease and dirt; it affects the extensor surfaces of hands and forearms, and the front of the thighs and knees. The prevention of cutting oil dermatitis and folliculitis is a matter of cleanliness of the skin and clothing, good washing facilities, and a protective skin-cream. C.

**Oil Dermatitis: Occurrence and Prevention.** R. F. Mackenzie. *Brit. J. Phys. Med. & Ind. Hyg.*, 1943, 6, No. 3, 89-90 (through *Bull. Hygiene*, 1943, 18, 843). Dermatitis due to exposure to machine oil affected 150 out of some 950 employees. Examination of the oil before and after use failed to indicate with certainty the noxious element at work. The oil was treated with phenols to keep down its microbic content, and was not found before or after use to contain any living bacteria. The most probable of the explanations put forward is that the oil dissolves the natural oils from the skin which then becomes dry, cracks and no longer keeps out microbes. Hence a secondary infection of the skin may take place by organisms normally present on it. Lead, picked up by the oil during use, may also possibly act as an irritant. The need for careful attention to the skin of the hands and arms is stressed. It should be washed with soap and water before and after work, and then anointed with lanolin which should be well rubbed in. Medical supervision is required, with inspection of the skin periodically, at least once a week. Any worker showing signs of impending dermatitis should be removed from exposure to the oil. Facilities for ultra-violet irradiation should be available to accelerate cure, or to arrest the condition. C.

**Juvenile Operatives: Recruitment.** E. M. Gray. *Textile Weekly*, 1943, 32, (1) 814, 816, 818, 820; (2) 846, 848. A report of an address on the problems of attracting juveniles to the Lancashire cotton industry, with special reference to the work of the Post-War Committee of the Cotton Board. Discussions by (1) the Preston and District Textile Managers' Association and (2) the British Association of Managers of Textile Works are reported. C.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

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### 1—FIBRES AND THEIR PRODUCTION

#### (A)—MINERAL

**Cotton: Cultivation in Uganda.** *Annl. Rept. Dept. Agric., Uganda Protectorate*, 1941-1942 (issued 1943), 10 pages. The following notes on cotton are given. (p. 2). The crop in 1941-42 reached about 236,370 bales, against 369,699 bales in the previous season. The weather was unfavourable and prices poor so that the area sown for the 1942-43 crop by the end of June was only 103,961 acres as against 371,989 for the previous season. (pp. 5, 6). Work at the Kawanda and Serere Experimental Stations is briefly reviewed. C.

**Egyptian Cotton: Supplies and Classification.** H. A. Hancock. *Textile Mercury and Argus*, 1944, 110, 33, 45. The distribution of Ashmouni, Zagora, Giza 7, and Karnak + Malaki cottons by grade and the amounts of these and other Egyptian cottons produced in recent years are tabulated and the present position of stocks is discussed. C.

**Indian Cottons: Production and Consumption.** D. N. Mahta. *J. Roy. Soc. Arts*, 1943, 91, p. 616 (through *Text. Mfr.*, 1943, 69, 546-547; *Text. Rec.*, 1943, 61, December, 42-43; *Indian Text. J.*, 1943, 54, 60-62). Recent advances in the production of Indian cottons are reviewed, with special reference to the part played by the Indian Central Cotton Committee. A table gives the production (in 400 lb. bales) of the main varieties for the seasons 1923-26 (averaged), 1941-42, and 1942-43. The total crops were 5,755,000, 6,025,000 and 4,429,000 bales, respectively, but the proportions of cotton above  $\frac{3}{8}$ -inch staple were 36, 59 and 72 per cent. The consumption of Indian cotton by Indian mills reached 4,025,000 bales in 1941-42 and exports were only 873,000 bales. Consumption of imported cotton was 635,000 bales and there is much need for reducing this by the production in India of more cotton above 1 inch in staple, the present crop being less than 200,000 bales. C.

**Cotton: Cultivation in the Lagunera Region of Mexico.** V. M. A. Antognoli. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 94, 82-91. An account is given of the soil, climate, provisions for irrigation, communications, markets, methods of cotton cultivation and harvesting, cotton pests and diseases, and facilities for ginning in the Lagunera (lagoon) region of Mexico which comprises parts of the states of Coahuila and Durango. The cotton grown is chiefly the variety Maravilla del Sur. Costs of production are rather high. Yields average 1,500 kg. per hectare, but in some parts may rise to 2,500 kg., ginning percentages are often as high as 40 per cent., and the grade of the fibre is very good. Average production in the period 1932-36 in bales of 230 kg. amounted to 118,953, representing about 52 per cent. of the total Mexican cotton production. C.

**Black Cotton Soil: Nitrogenous Manuring.** A. Sreenivasan. *Nature*, 1944, 153, 55. Groundnut cake, ammonium sulphate and farmyard manure or compost have all given significant response on the black soil tracts of India, the increases in yield in pounds of seed cotton per acre for unit dose of nitrogen being  $3.79 \pm 0.22$ ,  $2.24 \pm 0.17$  and  $1.19 \pm 0.17$ , respectively. The unexpected superiority of groundnut cake over ammonium sulphate is due to higher loss of nitrogen in the form of ammonia from the latter. This loss was considerably less where the fertiliser was drilled in furrows instead of broadcast as is usual. Application at lower depths also led to higher increases in yield. The high alkalinity and lime status of the black soil will doubtless favour heavy losses of ammonia, especially with high concentrations of added ammoniacal fertilizers, and it is possible that calcium nitrate may prove superior to ammonium sulphate for this soil. C.

**Cotton Weevil *Conotrachelus Denieri* (Hust.): Biology and Control.** P. C. L. Denier. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 94, 94-109. A detailed report is given of observations of eggs, larvae and adults of the weevil *Conotrachelus Denieri*, Hust. on cotton plants in Paraguay and Argentina, of the feeding habits of the larvae and adults and the resulting damage to the plants and bolls, and of proposed methods of control. Photographs of insects, larvae, and damaged bolls and plants are given. C.

**Cotton Plant: Defoliation for Mechanical Harvesting.** R. Garcia-Mata and A. Banfi. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 94, 77-81. A brief account is given of experiments carried out in the Mississippi Delta. Sections of cotton fields were dusted with calcium cyanamide to cause the leaves to fall from the plants and the quality of the cotton obtained from normal and defoliated plants was compared. With hand picking the differences were not significant, but with mechanical harvesting the cotton from the defoliated plants was superior in grade. C.

#### (B)—ANIMAL

**Correlation between the Fat Content of the Milk and the Wool in *Ovis aries*.** N. Pino and B. Genovesi. *Nuova Vet.*, 1941, 20, 3-8 (through *Animal Breeding Abs.*, 1943, 11, 234). In view of the similar embryological origin of the mammary and sebaceous glands, a correlation between the products of these glands appears likely. To test this assumption, 143 specimens of the Sicilian breed of sheep were examined, all of them between 3 and  $4\frac{1}{2}$  yr. old. The wool samples were taken from the rump, shoulder, and neck. The fat content of the wool taken from all three regions showed a positive correlation with the fat content of the milk, but only for the shoulder region was the correlation statistically significant. Significantly positive correlations existed between the fat contents of the wool in the three regions under test. W.

#### (C)—VEGETABLE

**Mysore Board of Sericulture: Organisation.** *Indian Textile J.*, 1943, 53, 409. Some particulars are given of new measures by the Mysore Government to foster sericulture, including (1) the personnel of a Board of Sericulture established on May 1st, 1942, (2) the salient points of a Silk Control Order, and (3) the objects of the silk filature expansion scheme as outlined by the president of the Board. C.

**(D)—ARTIFICIAL**

**Pulp: Production in France.** *Indust. Chemist*, 1943, 19, 675-676. Schemes for the production of pulp in France are briefly reviewed. They include the utilisation of the wild reed (*Arundo donax*) in the Rhône delta, and also its cultivation, and the erection of a sulphite pulp plant near Marseilles, with German backing. C.

**Cuprammonium Rayon: Production.** J. Constant. *Ind. textile*, 1942, 59, 116-117 (through *Chem. Zentr.*, 1942, ii, 1754 and *Chem. Abstr.*, 1943, 37, 6453<sup>3</sup>). A 20 per cent. cellulose solution is obtained by thoroughly kneading together cellulose, ammonia, water, basic copper sulphate and 24 per cent. caustic soda. C.

**PATENTS**

**Viscose: Production.** British Cellophane Ltd. B.P.558,096 of 18/2/1942: 21/12/1943 (Conv. 18/2/1941). In the preparation of viscose, a mixture of alkali metal cellulose xanthate and dilute aqueous alkali metal hydroxide solution is passed through a disintegrator which comprises a closed cylindrical housing supporting a mechanically driven rotor, capable of rapid rotation about a vertical axis and comprising a vertical shaft carrying vertically spaced blades, and a cylindrical perforate screen, surrounding the rotor and coaxial therewith, and having a large number of evenly spaced perforations, each perforation having a diameter or side of about 0.2 in. The disintegrated slurry is then passed through a second disintegrator of the same type to cause the xanthate to dissolve in the aqueous solution. C.

**Non-electrifiable Cellulosic Foil: Production.** Hercules Powder Co. U.S.P. 2,324,887. Wrapping foil that does not take a static charge is compounded of 70-90 parts of ethylcellulose with "viscosity above 90 centipoises", and 30-10 parts of nitrocellulose with "viscosity above 4 seconds." A graph shows the composition of the film plotted against the charge, in millimicro-coulombs, produced by rubbing with silk and with wool; zero charge is shown at an ethylcellulose:nitrocellulose ratio of about 74:26. C.

**Ethylene Polymer Filaments: Increasing Temperature of Shrinking.** E. I. Du Pont de Nemours & Co. U.S.P. 2,325,060. The shrinkage point of ethylene polymer filaments is raised by holding them taut at 30-2° C. below the melting point and then in the relaxed state at a lower temperature but not more than 40° C. below the melting point. An illustration shows yarn being heated on a vertical bobbin in a bath of fluid. C.

**Moist Fibre Lap Disintegrating Machine.** E. I. Du Pont de Nemours & Co. U.S.P. 2,325,147. A machine for disintegrating a compact, matted blanket of moist fibre into loose bunches of fibre comprises (1) a travelling lattice conveying the mass to (2) an upwardly moving toothed device, (3) a support frame pivoted on an axis spaced from (2) and carrying a roller (4) that rests on the fibre blanket close to (2), another roller (5) on the frame (3) above the blanket, and (6) a belt that rotates with and about the two rollers and assists in keeping the loose bunches of fibre in contact with the disintegrator (2) and returning excess bunches to the matted blanket. C.

**Cellulose Ester Spinning Solution.** Celanese Corporation of America. U.S.P. 2,325,153. A spinning solution of reduced viscosity comprises an acetone-soluble cellulose ester dissolved in a mixture of acetone and not more than 50 per cent. of a polymethylene monoxide in which the oxide link is across the terminal C atoms. C.

**Cotton Gin Pneumatic Lint Cleaning Device.** P. E. Hopper (Dallas, Texas). U.S.P. 2,325,183. The rail to which the gin ribs are secured has a passage for compressed air which is fed through ducts in the ribs into the roll box against the saws so as to remove trash from the lint on the saws. C.

**Rayon Spinning Pots.** American Viscose Corporation. U.S.P. 2,325,763, 2,325,786, 2,325,787. (1) A cover for a spinning pot is formed of radially slidable members that are thrown into locking engagement with the pot by the centrifugal force exerted in spinning. (2) and (3) The claims cover a device for insertion in a spinning pot for removing the member on which the rayon cake is supported. C.

**Rayon Incrustations: Prevention in Spinning.** Industrial Rayon Corporation. U.S.P.2,326,150. In the continuous production of rayon on the thread-advancing thread-store machine, the tendency for incrusting deposits to collect on the thread-advancing device is inhibited by treating the thread on the device with an oleaginous substance. C.

**Curly Cellulose Acetate Threads: Production.** G. Rutishauser (Switzerland; vested in U.S. Alien Property Custodian). U.S.P.2,326,174. Freshly spun threads still containing 4-10 per cent. of solvent from the dry-spinning process are wetted with 6-18 per cent. of water and fed to curling rollers. C.

**Nylon Staple Fibre: Production.** E. I. Du Pont de Nemours & Co. U.S.P. 2,327,087. Staple fibre of varying cross-sectional area and rough surface is obtained by forming a sheet of synthetic linear polyamide, and, as it travels in a given direction, subjecting it to violent impact while relatively free and unsupported, so that it shatters along lines in the direction of travel. The illustration shows the sheet from the spinning autoclave passing through two pairs of rollers into a "sub-divider" and to a "breaker" from which the staple fibre falls to a "collector." C.

**Dry Spinning Cell.** E. I. Du Pont de Nemours & Co. U.S.P.2,327,399. A hole in one side wall of a cell for the evaporative spinning of rayon is closed by a relatively thick member (1) having a circular sight opening (2) covered with transparent material, a light opening (3) below (2), two relatively long air inlet slots (4) by the side of (3) and making an angle of 60° at the centre of (2), and (5) short slots disposed about (2). The slots pass at an angle of 30° through the thick cover (1) so that evaporative medium that enters the cell through the slots is directed around the cell. C.

**Crimped Vinyl Resin Staple Fibre: Production.** Carbide and Carbon Chemicals Corporation. U.S.P.2,327,460. Continuous-filament vinyl resin containing a small proportion of a solvent is cut to staple and the fibre is exposed to steam, this causing contraction and crimping. C.

**High-tenacity Viscose Rayon: Production.** H. Fink and G. Plepp (Germany; vested in U.S. Alien Property Custodian). U.S.P.2,327,516. Viscose is spun into a bath containing sodium sulphate and 10-14 per cent. of sulphuric acid, and the filaments are swollen in a bath at above 90° C. containing 10-30 per cent. of sodium sulphate and 0.2-5 per cent. of caustic soda, and stretched by 50-100 per cent. The product is characterized by high tenacity and extensibility of more than 10 per cent. C.

**Far-hydrolyzed Cellulose Acetate: Production.** Eastman Kodak Co. U.S.P. 2,327,770. Cellulose acetate dissolved in a solvent that will mix with water but has a lower boiling point is mixed with a mineral acid hydrolyzing agent and kept in the warm until the acetyl content is reduced to between 28 and 13 per cent. Water is added from time to time to keep the cellulose acetate in solution. A graph in the specification shows acetyl content plotted against acetone content of mixtures of acetone and water, indicating the region in which the ester is soluble. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (B)—SPINNING AND DOUBLING

**Cotton Mill: Modernization.** J. Buckley. *Textile Weekly*, 1944, 33, 18, 53, 96, 136, 174. The author describes in some detail the modernization of a mill with 64,400 mule spindles and a normal output per 48 hours of 40,000 lb. of 36's (average) double roving yarn. A discussion is reported. C.

**Nomograph for Worsted Spinners.** M. C. Bishop. *Text. World*, 1943, 93, No. 10, 85. A nomograph is given and explained for determining the yardage of yarn on packages of various weights. W.

### (D)—YARNS AND CORDS

**Cotton and Rayon Tyre Cords: Development.** F. A. Westbrook, Jun. *India-Rubber J.*, 1944, 106, 71-73. Competition between rayon and cotton tyre cords is discussed, and it is pointed out that the outcome will depend on the competition between synthetic and natural rubbers, possible improvements in both types as a result of further research, price and other considerations. At present,

rayon cord has the advantages of higher strength and greater resistance to heat development which is greater with synthetic than with natural rubber. It is predicted that, although rayon, and to some extent nylon, will dominate the heavy truck and aeroplane tyre trade and find increasing use in other types of tyres, cotton will not be driven out of the tyre business. C.

#### PATENTS

**Rayon Staple Sliver False Twisting Apparatus.** N. S. Campbell (Greenwich, Connecticut, U.S.A.). B.P.558,268 of 24/6/1942:29/12/1943 (Conv. 6/5/1942). False twisting apparatus for slivers of rayon staple comprises pairs of rollers for feeding the sliver, means for revolving the rollers as a unit alternately in opposite directions at right angles to the feeding movement of the work, and means including a flexible shaft for rotating the rollers about their axes for feeding the work, which shaft is coiled about a carrier or housing which rotatably supports the rollers. C.

**Spindle Mounting.** Saco-Lowell Shops. B.P.558,526 of 11/6/1942:10/1/1944 (Conv. 10/10/1941). A mounting for spinning and twisting spindles is characterised in that the supporting means in the ring rail include non-metallic resilient cushioning means that isolate the spindles from the rail. C.

**Fibre Lap Dusting Apparatus.** E. B. and A. C. Whiting Co. U.S.P.2,324,787. A travelling lap of loose fibre is exposed to a stream of air laden with the dusting agent, circulating in a closed system in such a manner that the dusty air passes back and forth through the lap under sub-atmospheric pressure, fresh air is drawn in, and dust-free air is bled out of the system. C.

**Elastic Novelty Yarn.** Firestone Tire and Rubber Co. U.S.P.2,324,989. The claim is for a combination of (1) an elastic thread enclosed in a wrapping of core thread which lies along the axis of the elastic thread when this is stretched, (2) a wrapping of yarn in loose coils around the unit (1) with the same direction of twist, and (3) a final wrapping of binder thread with twist in the opposite direction. C.

**Fine Fibre Separating Apparatus.** Noble and Wood Machine Co. U.S.P. 2,325,159. Apparatus for separating fine fibre from a mass containing other materials, consists of a chamber in one wall of which is a hole occupied by a ribbed and grooved rotor that rotates at a high speed and draws off the fine fibre. C.

**Plastic Travellers.** Clark Thread Co. U.S.P.2,326,828-2,326,834. Seven patents cover the use of plastics for the wearing surface of travellers: (1) a synthetic linear super-polymer, (2) a vinylidene chloride polymer, (3) polystyrene, (4) cellulose ether, insoluble in water, (5) plasticized cellulose ester, (6) vinyl ester polymer, (7) acrylic polymer. C.

**Top Drafting Roller Guiding Device.** W. Stahlecker (Germany; vested in U.S. Alien Property Custodian). U.S.P.2,326,979. A drafting head comprising positively driven bottom rollers and two or more pairs of top rollers is fitted with a jointed guide lever at right angles to the axes of the rollers which is capable of oscillation in any direction and is linked to the saddle bar to which the top-roller saddles are connected, the joint between the bar and the lever permitting additional swinging of the saddle bar in any direction. C.

**Card Stripping Apparatus.** Abington Textile Machinery Works. U.S.P. 2,327,349. The apparatus extends the width of the card adjacent to the cylinder. It is provided with a series of closely spaced, narrow suction openings leading into a common suction conduit and a moving member is provided for automatically bringing successive openings into communication with the suction system. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (B)—SIZING

**Waxy Corn-starch: Properties and Uses.** H. H. Schopmeyer, G. E. Felton and C. L. Ford. *Ind. Eng. Chem.*, 1943, 35, 1168-1172. A general account is given of the properties, sources and isolation of waxy corn-starch. This starch is substantially pure amylopectin, and gives clear pastes which remain fluid even after standing for several days. Viscosity (hot pastes), settling rate, and moisture absorption curves for common corn, waxy corn, tapioca and potato



starches are shown. Waxy corn-starch can be used to replace tapioca for the production of dextrans, adhesives, sizes and coatings. It gives results comparable to tapioca and potato starches in textile printing, finishing and sizing operations. C.

(C)—WEAVING

**Looms: Adjustment to Prevent "Banging Off."** John Williamson. *Textile Mercury and Argus*, 1943, 109, 551, 671; 1944, 110, 42-43, 71-73, 75. The causes of "banging off" are discussed and hints are given on correct adjustments of the mechanism of Hattersley, Dobcross and circular box looms. C.

**Split Cloths: Weaving.** *Indian Textile J.*, 1943, 53, 402-403. Practical hints are given on denting and shedding for the weaving of narrow cloths on wide looms, inside "selvedges" being formed by "top doup" or "bottom doup" leno weaves. C.

(G)—FABRICS

**Industrial Cotton Fabrics: Development.** B. L. Whittier. *Textile Research*, 1943, 13, No. 13, 12-15. The development of industrial cotton fabrics in response to demands for fabrics meeting definite specifications for quality and uniformity is briefly discussed. Directions in which further research is desirable are pointed out, and the need for close cooperation between the manufacturers of industrial goods and the users of their products is emphasized. C.

**Textiles: Use by Railways.** W. Pritchard. *J. Textile Inst.*, 1943, 34, P151-155. C.

PATENTS

**Electrically Conductive Fabrics.** United States Rubber Co. B.P.557,929 of 14/10/1942:10/12/1943 (Conv. 15/10/1941). A soft, flexible fabric has fine heating conductors woven in the interior of the fabric so that their presence is hardly discernable so far as the feel and appearance of the fabric is concerned. The conductors are spaced near enough to each other to produce a nearly uniform heating action in a thick warm fabric, and each heating conductor is independently connected to two conductor leads so that if any heating conductor fails it will not render inactive the adjacent heating conductors. A fabric which is particularly suitable for electrically heated undergarments comprises an elastic fabric formed of interwoven textile and elastic threads and having woven in at spaced intervals as warp or weft heating conductors that are normally held in the fabric in a crimped condition but can straighten out as the fabric is stretched. The conductors may be copper wires but are preferably copper tinsel yarn consisting of a cotton yarn having a fine copper ribbon wound helically about the yarn. C.

**Circular Knitting Machine Wrap Stripe Device.** V. I. Jansson (Thornbury, Australia). B.P.558,067 of 10/7/1942:17/12/1943. A wrap stripe device for a circular knitting machine of rotating needle cylinder type comprising a rotatable head arranged eccentrically relatively to the needle circle, flat fingers each pivotally supported relatively to the head to constitute a lever of the first order, a yarn guide at the lower end of each finger, resilient means arranged to urge each finger to a position in which the yarn guide thereon will travel inside the needle circle during the complete rotation of the head and means to actuate the upper end of any selected finger to locate the yarn guide on the finger in a position wherein it will travel outside the needle circle to arrange wrap yarn on a selected needle or needles, is characterised in that the rotating head comprises two superposed discs having registering recesses in their contacting faces to form bearings for pins pivotally supporting the flat fingers in spaced radial slots in the head. Advantageously, some of the fingers are arranged in closely associated groups and the resilient means comprise resilient rings. On the lower end of the shaft of the rotatable head is fixed a yarn holder accommodating the knot connecting the tied off wrap yarns and engaging the respective wrap yarns so that the knot cannot be withdrawn to foul the knitting needles at the commencement of a striping operation. C.

**Winding Machines.** Universal Winding Co. B.P.558,082 and 558,090 of 12/6/1942:20/12/1943 (Conv. 16/6/1941). (1) In a yarn or like winding machine the thread guide is so constructed and arranged in relation to the winding spindle and a tension device or other device, such as a detector, situated between the thread guide and a yarn supply, from which yarn is led



by way of the thread guide to the winding spindle, that, during the winding operation, two adjacent parts of the strand situated at opposite sides of the thread guide lie substantially in alignment tangentially to the periphery of the package that is being wound, so that there is no change in tension in the yarn due to its passing through the thread guide. A slot or notch through which the yarn strand extends may be arranged at the underside of the thread guide, and in a convenient construction the thread guide has a depending bifurcated flange and is arranged to bear against the package being wound. Preferably the tension device is situated below the thread guide and arranged to be progressively adjusted by the rocking movement of the traverse means to decrease the tension applied to the yarn strand in proportion to its increase in linear speed so as accurately to control the tension on the yarn strand at the winding package. (2) A yarn winding machine having a traverse frame mounted to rock about the longitudinal axis of a pivotal support arranged in spaced relation to the winding spindle is characterised in that provision is made for adjusting the pivotal support angularly in relation to the axis of rotation of the winding spindle, for the purpose of enabling the machine to be used for winding cylindrical packages having planar ends when the pivotal support is adjusted to lie in parallel relation to the winding spindle, or conical packages having planar ends when the pivotal support is adjusted to lie at an angle in relation to the winding spindle. C.

**Straight-bar Knitting Machine Screw-racking Mechanism.** W. Cotton Ltd. and G. Wilders. B.P.558,126 of 18/6/1942:22/12/1943. In a Cotton's patent or other straight-bar knitting machine, screw-racking mechanism of the type comprising a rack wheel for rotating the screw, a pawl or clawker for racking the rack wheel, and spring-loaded locking mechanism, is characterised by release mechanism for releasing the locking mechanism at each racking operation of the pawl or clawker. This release mechanism may be arranged to function during an idle initial portion of the racking stroke of the pawl or clawker. The invention is applicable to mechanism wherein motion of the clawker, in one direction, is derived from a spring. Details are given of an example for racking narrowing fingers. C.

**Straight-bar Knitting Machine Sinkers and Catch Bar.** W. Cotton Ltd. and W. A. Cooper. B.P.558,127 of 18/6/1942:22/12/1943. A Cotton's patent or other straight-bar knitting machine having single-butt sinkers and a grooved catch bar for manipulating them, is characterised in that the sinker butts are tapered in width and the catch bar groove is correspondingly tapered in section. Preferably the taper is effected at both edges of the butt and at both walls of the groove. As a result of this construction even if a jack sinker butt is slightly misplaced when the catch bar descends to engage the jack sinker butts in the groove, the narrow end of the misplaced butt will enter the wide mouth of the groove and the butt will gradually be brought to its correct position. C.

**Stationary Weft-supply Loom.** M. Wright & Sons Ltd. and W. Williamson. B.P.558,128 of 18/6/1942:22/12/1943. A loom of the type in which the weft is drawn from a stationary weft supply, having an oscillating batten on which the weft layer is mounted, a member mounted on the batten for reciprocation along it to move the weft layer, and a stationary cam track for reciprocating the member as the batten swings to and fro, is characterised by a cam follower mounted on the member to engage the cam track. Preferably the cam track is located at an end of the batten and the member is in the form of a rod or bar with the cam follower mounted on the end of it. The weft layer (or each of them in the case of a loom constructed to weave simultaneously a number of widths of fabric) may be and preferably is in the form of a needle mounted on the bar to reciprocate therewith, though the invention may be applied to a loom having an oscillating needle, e.g. a needle oscillated by means of a pinion engaging a rack on the bar. A guide follower associated with the batten, and a stationary rectilinear guide along which the guide follower travels as the batten swings to and fro, in order to steady the batten against endwise movement, are provided. C.

**Knitting Machine Welt Hook.** H. J. Straussberger (Brooklyn, New York, U.S.A.). B.P.558,132 of 16/3/1942:22/12/1943. A welt hook comprising a shank constructed with a loop-holding beard and a beard-guarding latch

pivotally mounted on the beard side of the shank to swing for placement in a beard-opening position and a beard-closing position, the latch when in its beard-opening position being closable by yarn sliding along the shank and entering under the latch, is characterised in that the beard has a length capable of being engaged by the yarn, and the latch co-operates with the beard in such a manner that when in its closing position the yarn sliding along the beard may enter under the latch and open the same whereby all necessary latch movements for loop hooking and discharging purposes may be effected by the relative movements of yarn. C.

**Independent-needle Knitting Machine Needles: Feeding with Yarn.** B. Toone (Nottingham) Ltd., R. N. Toone and T. L. Allen. B.P.558,180 of 15/5/1942: 23/12/1943. In a method of introducing a yarn to the needles of an independent needle knitting machine, the yarn end extending from the feeder is substantially equal to, or slightly greater than, the distance from the feeder to the needle knocking-over point so that substantially the whole of the end is knitted in. The method comprises positioning the yarn, between a feeder and a trapper which grips the yarn end, so as to extend across the line of needles, lowering the yarn between the needles, and releasing the yarn end from the trapper at a moment when the length protruding from the feeder is substantially equal to, or slightly greater than, the distance from the feeder to the knocking-over point so that substantially the whole of the yarn end is knitted in. The method is primarily but not exclusively applicable to the introduction of splicing and plating threads, but is applicable to the introduction of any yarn or thread which in the courses whereat it is knitted is not the sole thread that is knitted. C.

**Stocking Blanks: Knitting.** G. Blackburn & Sons Ltd. and H. W. and E. Start. B.P.558,301 of 21/7/1942: 30/12/1943. In the production of a complete stocking blank on a straight-bar knitting machine the heel parts on the stocking blank are formed at the appropriate part by first widening the work on both sides of the blank by transferring loops outwardly at predetermined intervals to maintain a selvedge edge on the blank by a set of transfer points disposed on each side of the blank, each set comprising two groups operated so that the inner groups transfer the loops outwardly one needle and the outer groups transfer the loops outwardly two needles to obviate the formation of large eyelet holes, and subsequently narrowing the work to produce the desired shape for the heel parts. C.

**Loom Weft Stop Motion.** T. Pilling. B.P.558,321 of 23/6/1942: 31/12/1943. In a loom weft stop motion of the type employing a centre fork and having a supplementary slide with a notch for engaging a tippler to which feelers or prongs are attached, the supplementary slide is let into the main slide that is slidable in the weft fork bracket whereby the distance between the stop catch on the supplementary slide and the tippler fulcrum is increased so enabling a weaker spring to be employed for ensuring or accelerating the return movement of the tippler. The supplementary slide is connected with the main slide by a spring and has the amount of its movement in the main slide controlled by a pin and slot connection. The weft fork bracket in which the main slide is slidable is provided with a detachable guiding surface for facilitating the removal of the main slide, together with the supplementary slide. The main slide is formed with two stops one at each end. These stops form an integral part of the main slide and determine the amount of its movement. The weft fork bracket is made symmetrical so that it can be used for a right hand or left hand loom. The supplementary slide is advantageously formed with inclined guiding surfaces to work in a bed formed with corresponding surfaces in the main slide. The tippler may be made of a standard size and it is advantageously mounted in its correct position in the first instance so that no further adjustment is necessary. C.

**Bobbins Winding Spindle.** Courtaulds Ltd. and C. H. Hampson. B.P.558,331 of 29/6/1942: 31/12/1943. A bobbin spindle assembly for machines for winding yarns and threads on to bobbins supported on spindles provided with two whorls for driving, one of which is fixed on the spindle, is characterised in that the spindle is provided towards one end with a lug and the corresponding removable whorl is provided with an internal spiral groove such that a small

rotation of the whorl tightens it up against the bobbin. The time required for a bobbin-changing operation is considerably less with this arrangement than when using a bobbin spindle provided with a screw thread. C.

**Loom Shuttle.** W. V. Watson (Mytholmroyd). B.P.558,447 of 7/7/1942: 5/1/1944. A loom shuttle is made with a front that tapers towards each end from the centre (or near it) by an amount that corresponds with the angle of the shuttle box front. In this way the back of the shuttle is kept more in line with the reed at all times. This causes the shuttle to have a freer and more uniform flight and the knocking of the shuttle when it enters the opposite box is reduced to a minimum. The shuttle will weave with a less powerful pick and the flying off of the weft, formation of slugs in the cloth, turning over of the shuttle, marking of weft, and breakage of shuttle tongues are materially reduced. C.

**Winding Machine Thread Tensioning Mechanism.** British Nylon Spinners Ltd., G. Loasby, H. O. Puls and L. Pownall. B.P.558,631 of 10/7/1942: 13/1/1944. A thread tensioning mechanism for winding machines comprises a device having a cylindrical surface around which the thread can be wound in its passage from a supply package to a winding-on package and having one or more radial projections around which the thread can be looped, the device being angularly movable about the axis of the cylindrical surface so as to decrease the area of contact between the thread and device as the linear speed of the thread increases. The device may have a single radial projection in the form of a knob, or may have a number of radial projections formed by slots in one or more collars on the cylindrical member. C.

**Knitting Machine Yarn Guide Holder.** British Celanese Ltd. B.P.558,635 of 10/7/1942: 13/1/1944 (Conv. 22/7/1941). The guide holder comprises a block in which the guides are fixed, clipped to the supporting bar and provided with a protruding lug and other suitable means to assist in positioning it correctly on the bar. C.

**Loom Picker.** Gates Rubber Co. U.S.P.2,324,752. The picker comprises a cup-like holder for the buffer material, attached at its closed end to two substantially S-shaped parallel plates which are bolted together to grip the picker stick. C.

**Polyvinyl Resin Filter Fabric.** Walter Harz and others (Germany; vested in the U.S. Alien Property Custodian). U.S.P.2,324,838. A filter fabric that resists inorganic chemicals is woven from polyvinyl resin filaments and adjusted in porosity by heat treatment sufficient to cause partial softening. C.

**Self-threading Shuttle.** Luigi Pavia (Allentown, Pa.). U.S.P.2,324,949. A shuttle with forwardly extending thread passage and lateral delivery passage has a fixed guide and tension member pivoted at its forward end. This member has a lateral arm engaged by an elastic member so adapted as to hold it yieldingly in a downward position. C.

**Circular Knitting Machine Cleaning Apparatus.** Bahnson Co. U.S.P.2,325,023. The claim is for a set of downwardly directed nozzles on a hub that rotates about a vertical extension of the central support of the machine. Compressed air is led to the hub and as it escapes from the nozzles to blow down the machine the hub is set in rotation. C.

**Elastic Knitted Fabric.** Scott and Williams, Inc. U.S.P.2,325,078. A knitted fabric comprises face wales formed of contrasting yarns each knitted singly at certain wales, and back wales formed of these contrasting yarns and courses of an elastic thread, a number of courses of loops appearing in the back wales for each course appearing in the face wales. C.

**Narrow Fabric Loom Warp Feed.** G. J. Beaudreau (Kenyon, R.I.). U.S.P. 2,325,096. A warp-controlled friction beam and a ball warp mounting are carried by a frame and the warp yarns are led about the beam, through the means that control its rotation, and then through the healds. C.

**End-winding Yarn Package.** E. I. Du Pont de Nemours & Co. U.S.P. 2,325,127. A yarn package that can be unwound from one end and has at least some of the windings coated with a dry adhesive size, is characterized in that (1) a line drawn in any axial plane of the package between points representing the approximate limits of an end of the package forms with the yarn

support an angle that embraces the end of the package and is not more than  $65^\circ$ , (2) no portion of the end has tangents forming angles of  $90^\circ$  or more with the axis, and (3) the end portions with tangents between  $65^\circ$  and  $90^\circ$  are not more than 0.15 inch. C.

**Running Yarn Liquid Treatment Device.** E. I. Du Pont de Nemours & Co. U.S.P.2,325,129. Apparatus for applying liquid to a running yarn comprises a reservoir (shown as a feed pipe) from which projects a pair of flat plates between which the liquid rises by capillary action. The yarn is guided through a notch in the top edge of the pair of plates, and these are sealed down the sides. C.

**Laminated Fabric Picker.** A. P. Lewis (Fairhaven, Mass.). U.S.P.2,325,187. The picker comprises a loop section that grips the stick, a pad section made of strips of fabric that pass through the loop, and a non-metallic filling piece at the outer and forward side of the loop. The ends of the fabric strips are folded over the filling piece and overlapped one upon the other and a binder is used to unite all the parts into an integral structure. C.

**Knitting Machine Welt Hook.** Alfred Hofmann, Inc. U.S.P.2,325,208. The hook comprises a shank with continuous spring board, a latch mounted on one side of the shank near the tip of the beard, and a needle-receiving groove on the opposite side of the shank. C.

**Lipped Fabric: Structure.** L. J. A. Amyot (Quebec). U.S.P.2,325,215. The claim is for a fabric woven with a body section (a), a lip section (b) integral with the upper edge of (a), and a second lip section (c) integral with the upper edge of (b), so that a definite fold line or hinge connection is produced between the lip sections and reinforced edge portions are formed at the lower edge of (a), the upper edge of (b) and both edges of (c). C.

**Loom Protector Mechanism.** G. C. Tarte (Blackstock, S.C.). U.S.P.2,325,286. The mechanism comprises a sectional protector rod journaled in bearings on the swords and having fingers to engage the shuttle binders, an intermediate separate protector rod section, coupling sleeves that make contact with the inner ends of the bearings and are clamped to the ends of the end sections of the two protector rods, and a dagger carried by the protector rod to engage with the frog. C.

**Warp Pile Fabric: Construction.** W. J. Krijger (Deventer; vested in U.S. Alien Property Custodian). U.S.P.2,325,520. Two sets of complete pile tufts (a) and (b) are bound each around at least one weft thread and the (b) tufts are also bound in the direction of the warp over at least one of the (a) tufts. C.

**High-speed Winding Frame Traversing Device.** Owens-Corning Fiberglas Corporation. U.S.P.2,325,640. A pair of disks with fingers projecting from the rims are mounted parallel on a common axis on which they rotate in opposite directions. The fingers engage the yarn in its passage from the source to a winding spool, the two sets coming into play alternately, so that the yarn is moved back and forth along the spool. C.

**Rayon Yarn: Twisting and Setting.** William Liebig (Huntingdon, Pa.). U.S.P.2,326,043. Rayon yarn is soaked in a warm size, dried, twisted, set by heat and moisture at below  $212^\circ$  F., cooled somewhat, twisted in the reverse direction to less than half the first amount, and set again. C.

**Yarn Winding Machine Traversing Mechanism.** Barber-Colman Co. U.S.P.2,326,307. The guiding surfaces on the traverse device are operated by a cam to shift the thread along the rotating core of a package and guide means are provided to oppose movement of the thread by the traverse transversely of the core. C.

**Pick Counter.** Arnold Eddy (Middletown, Conn.). U.S.P.2,326,769. A device for counting and registering the number of picks in a predetermined length of fabric in the loom combines cloth measuring mechanism with a pick counter so that the latter starts to register when the former is connected up and automatically stops when the desired length is woven. C.

**Weft-replenishing Loom Thread Cutter and Clamp.** Crompton & Knowles Loom Works. U.S.P.2,326,862/3. The claims are for a thread cutter and clamp unit (1) pivotally carried by the shaft that operates the weft replenishing

mechanism, (2) for a loom having a temple cutter adjacent to the cloth fell and selvage, to cut a thread extending from the selvage into the shuttle box. C.

**Weft-replenishing Loom Pneumatic Thread Holder.** Crompton & Knowles Loom Works. U.S.P.2,326,905. As the bobbins drop to the shuttle their weft ends are caught in the draught through a pneumatic thread holder. This has an intake mouth with a relatively narrow opening for the end of the weft in the shuttle and, above it, a relatively wide opening for the ends of the bobbins in the magazine. C.

**Imitation China Cotton Blanket: Production.** W. S. Libbey Co. (Lewiston, Maine). U.S.P.2,327,278. The "oozy" weft yarn is given a wiry, harsh feel by treatment with an acid form of an amphoteric protein so that the blanket resembles one made from China cotton. C.

**Knitting Machine Jack and Needle Bed.** C. Koppel (Robbinsville, N.J.). U.S.P.2,327,356. The claim is for a flat-bed knitting machine jack and needle-supporting bed plate having channels in which the jacks and needles slide, and openings in the bottoms of the channels providing scraping edges across and in contact with which the jacks and needles move. C.

**Knitting Machine Yarn Feeder.** Jacquard Knitting Machine Co. U.S.P.2,327,747. The yarn from the spool (a) to the knitting instruments (b) passes out of the straight line over a member that moves as the length of yarn between (a) and (b) changes and is connected to an element that engages both driven and driving devices of the machine so as to determine its action. C.

**Electrically Heated Elastic Fabric: Construction.** United States Rubber Co. U.S.P.2,327,756. Textile and elastic threads are interwoven at spaced intervals with electrically conducting warp or weft that normally lies crimped in the cloth but is capable of straightening out at least 25 per cent. as the fabric is stretched. The conductors are connected to current leads. C.

**Magnetic Shuttle Drag.** Draper Corporation. U.S.P.2,327,840. One of two friction pads for the weft in a shuttle is attracted towards the other by means of a magnet and a stop is provided to limit its movement in that direction. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (C)—WEIGHTING

**Bleaching: Prevention of Fibre Damage.** H. Baier and W. Hundt. *Textilberichte*, 1943, 24, 73-79 (through *Chem. Abstr.*, 1943, 37, 6466<sup>7</sup>). Preliminary, intermediate and after-treatments, bleaching operations, bleaching-agent consumption, chlorine and peroxide bleaches, bath control and fibre testing are discussed. All attempts to prevent damage to the fibre during bleaching involve the lowering of the concentration of the bleaching agent. However, a mere reduction of the amount of bleaching agent in the bath does not guarantee the safety of the fibre or a satisfactory bleaching action. Other factors that are important are time of treatment, reaction temperature and stability of the bath. C.

**Cotton and Cotton-Rayon Goods: Bleaching.** G. Deuschle, W. Kling and G. Simon. *Textilberichte*, 1943, 24, 21-26 (through *Chem. Abstr.*, 1943, 37, 6466<sup>8</sup>). The Ce-Es bleaching process (D.R.P.653,989—treatment with an alkaline chlorine bleaching liquor followed by treatment with an alkaline liquor containing active oxygen), its application, appearance of treated goods, practical operation, and commercial installation are described fully. C.

##### (D)—MILLING

##### Correction

See page A12. The first abstract in Section 4(D) should be preceded by the following line:—

**Scouring and Milling All-worsted Khaki Serge.** D. R. H. Williams. *Wool*

##### (E)—DRYING AND CONDITIONING

**Rayon: Drying.** H. P. Simons, J. H. Koffolt and J. R. Withrow. *Trans. Amer. Inst. Chem. Engrs.*, 1943, 133-135 (through *Textile Research*, 1943, 13, No. 13, 27-28). The results of a study of the effect of drying conditions on the drying of 150-denier, 40-filament viscose rayon yarn in skein form showed that the rate of drying of this rayon yarn, previously centrifuged and under the con-

ditions investigated, conformed to the usual drying equation

$$-dW/d\theta = 1.24G^{1.47}(\Delta H)W,$$

where  $dW/d\theta$  = rate of drying, lb. of water evaporated per hour per lb. of bone dry stock,  $G$  = mass velocity, lb. per min. per sq. ft. cross sectional area,  $\Delta H = H_s - H_a$  = saturation humidity corresponding to wet bulb temperature of air - humidity of main stream of air, lb. water per lb. dry air and  $W$  = free moisture content of stock, lb. water per lb. of dry stock. This equation represented only the falling rate period of the normal commercial rayon drying conditions. The drying conditions investigated, room temperature to 200° F., 2-40 per cent. R.H., and air velocity 20-60 lb. per min. per sq. ft. of cross-sectional area, caused no observable degradation as shown by determinations of wet strength, extensibility, copper number and cuprammonium viscosity. In a study of the drying of rayon cakes (150-denier, 40-filament) made by the "viscose pot process" it was found that the electrical resistance of the rayon cakes varied with the moisture content. An instrument for measuring the resistance is described. The equation  $-dW/d\theta = 0.88(\Delta H)G^{0.8}W$  was found to represent the rate of drying of the cakes. Drying under the conditions investigated had no noticeable effect on copper number and cuprammonium viscosity. C.

#### (H)—MERCERISING

**Mercerising Liquor: Alkali Recovery.** W. P. Koretko. *Khlopchatobumazh. Prom.*, 1940, 10, No. 8, 24-29 (through *Chem. Zentr.*, 1941, i, 3025 and *Chem. Abstr.*, 1943, 37, 6466<sup>2</sup>). Investigations are reported on the technical balance of the caustic soda consumption in the mercerisation of cotton and suggestions are offered for saving fresh caustic soda and utilisation of the spent liquor. C.

#### (I)—DYEING

**Direct Dye Mixtures: Absorption by Cellulose.** S. M. Neale and W. A. Stringfellow. *J. Soc. Dyers & Col.*, 1943, 59, 241-245. Observations with pairs of direct cotton dyes have shown that the spectra of the dyes in mixtures in water are not additive. In general, the component absorbing at shorter wave lengths shows an enhanced light absorption in the mixture, whilst that absorbing at longer wave lengths shows a less intense absorption and a shift of the absorption maximum towards still longer wave lengths. In 25 per cent. pyridine solution, however, the spectra are additive in mixtures. The absorption peak for a single dye is shifted towards longer wave length by about 200 Å. in 25 per cent. pyridine as compared with water. When mixtures were dyed on to cotton, the absorption of at least one component, relative to its absorption when dyed singly, was reduced markedly below the value to be anticipated merely from the competition of the two dyes for the available surface. Pairs of dyes, the spectra of which indicated marked interaction, showed the greatest anomalies in dyeing. The interference of one dye with the absorption of a second dye increased as the temperature was lowered. In a mixture of Chlorazol Sky Blue FF (0.05 g. per l.) and Chrysophenine G (0.10 g. per l.), the absorption of the blue dye at equilibrium decreased with the fall of temperature, whereas that of the yellow dye increased in the usual way. It is suggested that quite small temperature variations may cause unevenness in mixture dyeing, at least if extremely long goods-liquor ratios are used in prolonged dyeings. The time required to reach equilibrium in dyeing on cellulose sheet was, for all direct dyes dyed in a mixture, up to twice as long as that required for each dye applied singly. In this respect, therefore, the behaviour of mixed dyes can be very roughly inferred from their rates of diffusion into cellulose measured when dyed singly. C.

**Dyes: Analysis.** P. Baffroy. *Teintex*, 1940, 5, 291-298 (through *Chem. Zentr.*, 1941, i, 3150 and *Chem. Abstr.*, 1943, 37, 6461<sup>9</sup>). Various measures which are useful for the recognition of the dye on the fibre include removal of the dye from the fabric, treatment of the fabric with hypochlorite, melting with paraffin (especially for naphthols), sublimation, solution in pure or dilute pyridine, investigation for hydrogen sulphide (sulphur dyes, etc.), reduction with hydro-sulphite (vat dyes), diazotisation and the action of  $\beta$ -naphthol (primuline dyes). C.

**Dyes: Analysis.** K. D. Shcherbachev. *Org. Chem. Ind.* (U.S.S.R.), 1940, 7, 577-580 (through *Chem. Zentr.*, 1941, i, 2725 and *Chem. Abstr.*, 1943, 37, 6464<sup>9</sup>). The following methods are recommended for use in azo dye works. Excess aryl peri-acids are determined by extracting with isoamyl alcohol,

coupling the extract with 1:3:6-diazonaphthalenedisulphonic acid and measuring the dye formed colorimetrically. The accuracy is 1.1.5 per cent. The Azotol content in Rapidogen dyes is determined by azotization in pyridine solution. A rapid method for the determination of *o*-nitroaniline in *p*-nitroaniline is reported. Nitrobenzene impurities in aniline are determined by a potentiometric method which depends on the fact that the polarization of a hydrogen electrode is proportional to the nitrobenzene content. The moisture content of dyes can be rapidly determined by measuring the dielectric constant.

C.

**Dyes: Improvement of Fastness.** B. N. Myl'nikov and S. P. Surovtsev. *Khlopchatobumazhnaya Prom.*, 1940, 10, No. 8, 29-31 (*Chem. Zentr.*, 1941, i, 2451-2452 and *Chem. Abstr.*, 1943, 37, 6463<sup>3</sup>). The possibility of improving the fastness of substantive dyes by treatment with copper salts, with dichromate, sulphates, alumina, etc., was investigated. As no satisfactory results were obtained the work was continued with chrome dyes instead of substantive dyes. Colours obtained with chrome dyes in the presence of pine extracts were especially fast. Directions are given for dyeing tobacco, chocolate, olive, beige and yellow shades in the presence of chromates. The following method was developed for fast dyeing with bordeaux dye: The material is dyed in a mixture of 16 g.  $\beta$ -naphthol, 2-3 g. Azotol MNA, 6 g. castor oil soap (25 per cent.), 38 g. caustic soda of 22° Bé. diluted to 1 l. with hot water. After dyeing and wringing to a moisture content of 85-90 per cent. and subsequent drying the material is dyed with diazo-1-naphthylamine, using 10 g./l. By mordanting cotton with chromium and iron hydroxides in the presence of tartaric acid fast shades of beige and ecru are obtained.

C.

**Mixed Fibre Textiles: Dyeing with Vat Dyes.** F. Danisch. *Kleppig's Textil-Z.*, 1942, 45, 504-505 (through *Chem. Zentr.*, 1942, ii, 1741 and *Chem. Abstr.*, 1943, 37, 6463<sup>2</sup>). Practical suggestions are made and the treatment of the dye with the needed amount of caustic soda and hydrosulphite, and the dyeing at 15-16° without caustic soda and hydrosulphite are discussed. The dyes for use on mixed textiles, e.g. staple fibre and flock bast, must be selected very carefully. There are no levelling problems with the Anthrasol dyes, which must be used in corrosion-resisting apparatus as they require sulphuric acid.

C.

**Silk and Rayon Hosiery and Knitted Wear: Dyeing and Finishing.** R. Hünlich. *Kunstseide u. Zellwolle*, 1942, 24, 332-333 (through *Chem. Zentr.*, 1942, ii, 1645-1646 and *Chem. Abstr.*, 1943, 37, 6465<sup>3</sup>). Silk hosiery requires additional wetting shortly before manufacture. Hosiery and knitted wear are usually manufactured from raw yarn and dyed afterwards in special equipment or sometimes in the vat. Substantive dyes are used mainly for rayon goods. Thorough degumming of silk hosiery is carried out before dyeing and washing at 70°. Degumming and dyeing can be combined only for hosiery containing silk or part cotton. Substantive direct dyes are used for silk to a limited extent. They are preferred for dyeing cotton portions. To give a dull finish to rayon hose, highly sulphonated oils and fats can be used forming salts with certain compounds which become attached to the fibre.

C.

**Spun Rayon and Aralac Piece Goods: Dyeing.** Allison Fitzgerald. *Textile Bull.*, 1943, 64, No. 9, 14 B, 34; No. 10, 20, 22, 42-43; No. 11, 14, 16, 34 (through *Chem. Abstr.*, 1943, 37, 6463<sup>8</sup>). (1) Direct neutral wool dyes and special types of acid and wool dyes having special value for processing Aralac are discussed. Practical suggestions are made for preparing the dyebath and recommendations are given on tinting agents for Aralac and the best methods for removing them prior to bleaching and dyeing. The scouring, bleaching and finishing of spun rayon and Aralac goods are discussed. (2) Fastness requirements and the use of suitable direct dyes are described. (3) The preparation of greige goods, desizing, spun rayon-cotton fabrics and spun rayon-acetate rayon fabrics are discussed.

C.

**"Utility" Cotton Linings: Dyeing and Finishing.** *Textile Manufacturer*, 1943, 69, 541-543. Particulars are given of the "Utility" range of silesias and other linings, with practical notes on their processing.

C.

**Anthraquinonoid Vat Dyes: Reversible Reduction.** D. A. Clibbens. *J. Soc. Dyers & Col.*, 1943, 59, 275-279. Reference is made to a recent paper by a Brassard on the reduction of indanthrone, and the relevant work of Geake and



his co-workers is reviewed. It is pointed out that, although the energy changes associated with the reversible reduction of the anthraquinonoid vat dyes cannot yet be completely accounted for on the basis of their electronic structures, the study of the subject has reached a stage at which the formulation of indanthrone and its vat in à Brassard's paper should not be regarded as more than a partial and simplified picture of the true state. C.

**Azo Lead Dyes: Production.** C. G. Stuckwisch. *Iowa State Coll. J. Sci.*, 1943, 18, 92-94. A report is given of investigations of halogen-metal inter-conversions using *n*-butyllithium, the preparation of organo-lead compounds from organo-lithium compounds and triaryl- or trialkyllead halides, the preparation of organo-lead compounds containing an azo linkage joined to the lead atom through carbon atoms, and the products obtained by coupling various diazonium salts with triphenyl-*o*-hydroxyphenyllead, triphenyl-*o*-dimethylaminophenyllead, and triethyl-*o*-dimethylaminophenyllead. Dyes varying in colour from dull red to dark brown were obtained. C.

**Dyer's System of Colour Matching: Physical Significance.** E. Waters. *J. Soc. Dyers & Col.*, 1943, 59, 261-266. A report is given of a lecture on the same lines as a paper by White, Vickerstaff and Waters, but before a different audience. The discussion is also reported. C.

**Astrakhan Fabric and Curl Cloth: Dyeing.** "Concord." *Text. Merc.*, 1943, 109, 718-721. Astrakhan fabric, woven on Dobcross looms, with a mohair or worsted pile, is pressure steamed and desized before dyeing, for which level dyeing acid colours are generally used. Barriness caused by variation in dye affinity may be due to faulty procedure during curling and setting the warp, or to the presence of insoluble soap residues from warp scouring. Acid blacks are simpler to apply than logwood and are less likely to affect the shade of the sulphur black on the cotton foundation. Astrakhan fabric with jute pile usually has a grey cotton foundation, both pile and foundation being dyed in a single bath with a direct cotton dye. Curl cloth is knitted on a circular machine and then milled to raise the pile loops. Prolonged dyeing of this fabric results in excessive shrinkage. W.

#### (J)—PRINTING

**Fabrics: Printing.** L. Bonnet. *Teintex*, 1941, 5, 225-229 (through *Chem. Zentr.*, 1941, i, 3150 and *Chem. Abstr.*, 1943, 37, 6464<sup>3</sup>). A general discussion of printing with vat dyes, indigosols, naphthazols (naphthols) and naphthazogens, printing on acetate rayon with Astrazone dyes in combination with Brecolane NCI (for working the dye into a paste) and with the paste Acetanol NT, and resist and discharge printing. A new method of pigment printing which makes steaming, development and subsequent washing (with soap) unnecessary is discussed. The pigments, e.g. vat dyes, are suspended in cellulose derivatives dissolved in organic solvents. The printing is done with shallowly engraved rollers. In the case of Impralac dyes the pigment is mixed with an artificial resin and emulsified with water. The Impralac dyes are fixed simply by heating and are fast to rubbing and to washing. C.

**Napped Fabrics: Printing.** Malcolm Mackay. *Textile World*, 1943, 93, No. 10, 89. Troubles caused by loose nap in the printing of flannels and the like are overcome by the following procedure: (1) Brush the cloth well and lightly starch, mangle and tenter it. (2) File the doctor blades with as short a bevel as possible for the type of engraving and slightly round off the edge with a stone. (3) Wrap the ends of the wooden furnisher that touch the printing roller beyond the edges of the cloth so that the furnisher does not press on the part of the roller that comes in contact with the cloth. (4) Avoid suction on the goods behind the machine, keep the cloth away from brushes or other objects that would raise the nap, and keep tension in the cloth to a minimum. (5) Keep the printing colour thin and just before use add half a gallon of methylated spirit for every 20 gallons of colour. C.

**Soybean Protein Dispersions: Preparation and Use in Printing Inks.** A. F. Schmutzler and D. F. Othmer. *Ind. Eng. Chem.*, 1943, 35, 1196-1202. Conditions for the preparation of dispersions of soybean protein in polyhydric alcohols were investigated and a procedure was developed which comprises rapid heating to 125° C., maceration at 125° C., and heating at 135° C. Dis-



persions containing 20 per cent. and 30 per cent. of the protein in diethylene-glycol were prepared with guanidine carbonate as dispersing agent, and were used in the preparation of printing inks. Satisfactory inks were obtained, although not all pigments can be used with these dispersions. The inks set well and are distinguished by their dull appearance after hardening by exposure to steam. Comparisons with other commercial proteins showed that blood albumin, casein, and alkali-extracted protein from maize disperse more readily in diethylene-glycol than does soybean protein. C.

**Pigments Applied to Textiles.** E. Sewell. *Canadian Text. J.*, 1943, 60, No. 22, 41-42, 44, No. 24, 32-33. Pigmentation by the formation of precipitates within the fibre, e.g. mineral khaki and chrome yellow, and by the fixation of insoluble colouring matters with adhesives of the starch, modified cellulose and synthetic resin classes, is reviewed. Preparation of the fabric prior to the application of fixatives is discussed. The technique of applying pigments and synthetic resin together is outlined. W.

#### (K)—FINISHING

**Crease-resistant Fabrics: Production.** A. F. Lomanovich and S. B. Tyuleneva. *Tekstil. Prom.*, 1941, No. 3, 47-50 (through *Chem. Zentr.*, 1942, ii, 1753 and *Chem. Abstr.*, 1943, 37, 6466<sup>a</sup>). The Tootal-Broadhurst Lee process has been investigated on crêpe fabrics with viscose weft and on cotton voile. The experiments are carefully described and the results are summarised in nine tables. The authors conclude that crease resistance is most suitably produced with dimethylolurea and dimethylolthiourea, which are obtained by reaction of formaldehyde with urea or thiourea in a weakly alkaline solution. If a curing chamber heated to 180° is not available, the resin can be polymerised by passing the fabric for 5 min. over drying cylinders. Good results are obtained on mixture fabrics with cotton warp and viscose rayon weft. The process is said not to be suitable for all cotton fabrics because of its tendency to reduce the strength of the weft. C.

**Formaldehyde-treated Rayon: Degree of Polymerization.** F. Vogel. *Zellwolle, Kunstseide, Seide*, 1942, 47, 800-808 (through *Chem. Abstr.*, 1943, 37, 6465<sup>a</sup>). The nitration of formaldehyde-treated rayon and staple fibre produces a nitrate (soluble in acetone) and liberates formaldehyde. This nitrate can be used for the determination of the degree of polymerization (by measuring the viscosity of the solution) of cellulose in formaldehyde-treated rayon fabrics. The average polymerization is decreased by formaldehyde treatment, by an amount that depends on the type and concentration of the catalyst used and on other finishing conditions. The resistance to scouring decreases with decreasing degree of polymerization. The degradation of the cellulose is more extensive in the presence of catalyst than in the presence of formalin. At the same degree of degradation the resistance to scouring of fabrics which were treated only in the presence of catalysts is better than that of formaldehyde-treated goods. By the proper selection of catalyst it is possible to attain low degree of swelling, low degradation of cellulose and good resistance to scouring. C.

**Fabric-Resin Sole Leather Substitute.** W. Galley. *J. Amer. Leather Chem. Assoc.*, 1943, 38, 250-255 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 334). A thermoplastic resin, usually polyvinyl butyral, is friction-calendered into a medium cotton duck of open weave, and a number of layers of impregnated cotton are laminated together. The fabric stabilises the resin against permanent set and increases the tear strength. The resulting material has a coefficient of friction between that of leather and rubber and a laboratory abrasion-resistance  $2\frac{1}{2}$  times that of leather. C.

**Urea-Formaldehyde Resin: Use for Improving Wet Strength of Paper.** R. J. Myers and G. V. N. Morin. *Paper Trade J.*, 1943, 117, TAPPI, 241-246. The addition of synthetic resins to paper stock for the purpose of improving the wet strength of the paper is discussed. A new type of urea-formaldehyde resin (Uformite 466) is an acceptable beater size. A report is given of a study of the wet-strength characteristics of hand sheets made with the resin added at the beater or some point prior to sheet formation. Data showing the effects of resin

concentration, catalyst concentration, time and temperature of drying, type of pulp, and other factors on dry and wet tensile, tearing and bursting strengths are tabulated and discussed. It is pointed out that the resin appears to react specifically with the cementing substance in beaten stock. C.

**Cow's Hair and Cow's Hair Felt: Processing.** S. Wouble. *Text. Col.*, 1943, 65, 507-509. Deliming is done by immersion for 12 hr. in dilute spirits of salt at 100° F., 5 gal. commercial yellow spirits being used in approx. 100 gal. water if the hair is heavily encrusted with lime; the temperature must be kept fairly constant. After rinsing, the hair is scoured at 100° F., using warm water and soda in the first bowl and at least 30 lb. soda ash and 2 gal. olein to 1000 gal. water in the second bowl. Suitable dyes and dyeing apparatus are recommended for both unfelted and felted hair. If weighting is necessary, add 12 per cent. sumach extract in paste form to the acid dyebath after exhaustion is fairly complete, and rinse in calcareous water. The felts are then worked in cold 4° Tw. pyrolignite of iron for 30 min., rinsed, treated in a solution of brown glycerine, dried and conditioned. W.

#### (L)—PROOFING

**Neoprene Latex: Effect of Thickeners on Viscosity.** B. Dales, R. H. Walsh and H. H. Abernathy. *India Rubber World*, 1943, 107, 565 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, Sheet 32:431:1). The authors record the effects of various thickeners on the viscosity of Neoprene latex Type 571 (Du Pont), compounded with zinc oxide and "Neozone" antioxidant. Casein and glue caused immediate thickening, but after a few days the viscosities began to fall and eventually returned to normal. Gum arabic produced a very gradual rise in viscosity which was not much greater even after two weeks. Corn starch had no effect. Ethylcellulose gave some thickening which was fairly permanent. Methylcellulose gave the desired effects—a rapid and permanent rise in viscosity. Low-viscosity methylcellulose (Dow's 15-centipoise Methocel) is preferred to the high-viscosity ether (100 cp.) because it is easier to handle and immediate in action. C.

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dried and proofed again up to 10 times. The per cent. losses in strength and the fluidity increases were:

Treatment.	a	b	c	d	e	f	
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#### PATENTS

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**Polymethylolamide Ethers: Production.** Imperial Chemical Industries Ltd. (E. I. Du Pont de Nemours & Co.). B.P.557,932 of 15/9/1941:13/12/1943. Ethers of polymethylolamides are prepared by reacting an aliphatic poly (N-methylolcarbonamide) under substantially anhydrous conditions at a temperature below 100° C. in the presence of a catalyst having an H ionization constant of at least  $1 \times 10^{-2}$  with an alcohol containing not more than 5 C atoms in which the carbinol C atom bears at least one H, whereby monomeric aliphatic poly (carbonamido-methyl) ethers are obtained. The products may be used in resin-forming reactions with compounds having alcohol or thiol groups or at least two amino H atoms, in modifying alkyd and urea-formaldehyde resins, e.g. in coating compositions, and as textile finishing agents, e.g. for imparting crease resistance. C.

**Nylon Fibres: Dyeing.** Courtaulds Ltd. and J. Boulton. B.P.557,939 of 9/6/1942:13/12/1943. A process of obtaining level shades on nylon fibres comprises pre-treating the nylon fibres with an aqueous solution of hydrogen

concentration, catalyst concentration, time and temperature of drying, type of pulp, and other factors on dry and wet tensile, tearing and bursting strengths are tabulated and discussed. It is pointed out that the resin appears to react specifically with the cementing substance in beaten stock. C.

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**Felted Fabrics: Manufacture.** Anglo Felt Industries Ltd. and H. Neuhaus. B.P.556,186 of 23/9/1943. A fleece or lap of felted fibres is secured by needling to Hessian or the like, the surface of which has been treated with an adhesive which is still tacky. If a thermo-adhesive substance is used, it is allowed to dry, and brought to the adhesive state by heat immediately before needling. The fleece may be applied to one or both sides of the base, and a second fleece may be needled in the same way to an already-secured fleece. After needling, the fabric may be further felted or milled. W.

**Felted Fabrics: Manufacture.** Anglo Felt Industries Ltd. and H. Neuhaus. B.P.556,977 of 29/10/1943. The felted material comprises a mixture of long and short fibres. The long fibres are processed in a Garnetting or similar machine to produce a fleece; the short fibres are sifted from a rotary perforated drum or cage directly on to the fleece after it leaves the doffer and whilst on the conveyor of a Blamires feed or similar lapping machine. An adhesive may be applied to the fleece before the short fibres are applied. The invention is particularly applicable to the manufacture of sound-absorbing padding in which a small proportion of asbestos fibre is mixed with a long fibre, e.g. goat or horse hair, or vegetable fibre. W.

**Polymethylolamide Ethers: Production.** Imperial Chemical Industries Ltd. (E. I. Du Pont de Nemours & Co.). B.P.557,932 of 15/9/1941:13/12/1943. Ethers of polymethylolamides are prepared by reacting an aliphatic poly (N-methylolcarbonamide) under substantially anhydrous conditions at a temperature below 100° C. in the presence of a catalyst having an H ionization constant of at least  $1 \times 10^{-2}$  with an alcohol containing not more than 5 C atoms in which the carbinol C atom bears at least one H, whereby monomeric aliphatic poly (carbonamido-methyl) ethers are obtained. The products may be used in resin-forming reactions with compounds having alcohol or thiol groups or at least two amino H atoms, in modifying alkyd and urea-formaldehyde resins, e.g. in coating compositions, and as textile finishing agents, e.g. for imparting crease resistance. C.

**Nylon Fibres: Dyeing.** Courtaulds Ltd. and J. Boulton. B.P.557,939 of 9/6/1942:13/12/1943. A process of obtaining level shades on nylon fibres comprises pre-treating the nylon fibres with an aqueous solution of hydrogen

peroxide, K permanganate, nitric acid, Na perborate, or K persulphate, or an acid solution of pH less than 3, and dyeing the pre-treated nylon fibres with a direct cotton dye. C.

**Monoazo Dyes: Production.** A. H. Knight, W. E. Stephen and Imperial Chemical Industries Ltd. B.P.558,058 of 15/6/1942:17/12/1943. Monoazo acid dyes for wool and silk are made by diazotising an amine of the general formula  $X.CO.NY.R.NH_2$ , in which R stands for a *m*- or *p*-phenylene residue which may carry simple azo dye substituents, e.g. methyl, methoxy or sulphonic acid groups, but is devoid of nitro groups, X stands for a monochloro- or monobromo-alkyl ( $C_1$  to  $C_6$ ) radical, and Y stands for hydrogen, alkyl ( $C_1$  to  $C_6$ ), cycloalkyl, aralkyl, alkoxy-alkyl, or aryl, and coupling under neutral or alkaline conditions the diazo compound so obtained with 2-amino-8-naphthol-6-sulphonic acid or a derivative thereof in which the amino group carries as substituents alkyl, cycloalkyl, aralkyl or hydroxyalkyl groups. C.

**Laminated Fabric.** British Celanese Ltd. B.P.558,129 of 18/6/1942:22/12/1943 (Conv. 31/7/1941). A laminated fabric article comprises an interlining fabric having a curved edge, and an outer fabric cut on the bias and folded to enclose the interlining, a fold-line of the outer fabric being constrained to follow the curvature of the edge, and the two fabrics being united by means of thermoplastic material contained in at least one of them. In a particularly advantageous form the interlining fabric is in the form of a strip having one long edge convex and the other concave, and the outer fabric is cut on the bias in the form of a rectangular strip and folded twice to enclose the interlining fabric closely in an envelope with overlapping long edges, each fold line of the outer fabric being constrained to follow the curvature of one of the long edges of the interlining fabric. Laminated fabric articles of this construction make very satisfactory sweat-bands for hats, especially when the outer fabric is composed of fibres of water-resistant film-forming material such as cellulose acetate. Preferably the outer fabric is made wholly or in part of yarns of a thermoplastic material such as cellulose acetate or other organic derivative of cellulose and this fabric is united with a curved interlining which contains a plasticizer for the thermoplastic material contained in the outer fabric. The interlining may itself be made of or contain yarns of a thermoplastic film-forming material or it may be made of yarns of a non-thermoplastic material, e.g. cotton, regenerated cellulose, linen, wool, or silk. When the inner layer is made wholly of yarns of a non-thermoplastic material it may be coated with a thermoplastic material. C.

**Polyamide Materials: Dyeing.** N. H. Haddock, W. B. Smith and Imperial Chemical Industries Ltd. B.P.558,159 of 19/6/1942:23/12/1943. Yellow shades of improved fastness to light are produced on synthetic fibre-forming linear polyamide materials by dyeing with aqueous dispersions of given general formula, examples of which are obtained by heating together oxindole or an N-alkyl oxindole and either an iminophthalimide or *o*-cyanobenzamide or a mixture of phthalic anhydride or phthalimide with urea and ammonium molybdate or, in the presence of a substance facilitating the removal of water, a phthalimide, or by heating together an N-alkyl oxindole and thiophthalimide in the presence of piperidine. The dye bath may be made up merely by stirring the finely powdered dye in water, or dispersing agents may be added. The material to be dyed is conveniently added to the cool solution and the temperature of the bath is then raised to, e.g. 85° C., and dyeing is continued  $\frac{1}{2}$  to 1 hour. The polyamide materials may be in the form of fibres, threads or fabrics or in sheet or block form. C.

**Laminated Cellulose Acetate Plastic Material: Production.** Cotopa Ltd. and E. Chippendale. B.P.558,164 of 19/6/1942:23/12/1943. A cellulose acetate plastic material is manufactured by impregnating a fabric of cellulose acetylated with maintenance of the fibrous structure and insoluble in acetone, with a viscous solution in acetone of cellulose acetate and a plasticizer. The solvent may then be allowed substantially or wholly to dry off. Several such layers may then be compressed with the aid of gentle heat to consolidate the material. The material thus produced furnishes boards having good mechanical strength and having the great advantage of dimensional stability when exposed to atmospheric conditions of varying relative humidities. C.

**Disazo Dyes: Production.** J. R. Geigy A.-G. (Basle). B.P.558,219 of 28/7/1942:24/12/1943 (Conv. 29/7/1941). Red acid disazo dyes of good fastness to light and sea water are made by tetrazotising diaminodiphenyl sulphones or diaminodiphenyl sulfoxides or their derivatives (such as the alkyl, alkoxy or halogen derivatives) free from sulphonic and carboxylic acid groups and combining the resulting tetrazo compounds with two molecules of 2-amino-8-hydroxynaphthalene-6-sulphonic acid in acid solution. C.

**Fabric Impregnating Machine.** Texproof Ltd. and H. Czechowitzka. B.P. 558,261 of 19/6/1942:29/12/1943. A machine for impregnating fabrics with a volatile liquid or with a solution containing a volatile liquid comprises a tank or vessel of a length to suit the width of the fabric, a roller(s) beneath the surface of the liquid, squeezing means to remove excess of liquid from the fabric before it leaves the tank or vessel, and a lid which makes a joint with the vessel except for gaps parts where the fabric passes into and out of the vessel. The thickness of the fabric serves to seal these gaps and the adjacent surfaces of the lid and vessel serve as spreader blades on both sides of the fabric. C.

**Stearato Chromic Chloride Waterproofing Emulsions: Preparation.** E. I. Du Pont de Nemours & Co. B.P.558,317 of 13/5/1942:31/12/1943 (Conv. 17/5/1941). A stable emulsion having adhesive and waterproofing properties is obtained by dispersing a polymeric organic film-forming material, e.g. polymerised vinyl acetate, nitrocellulose or other monomers or cellulose derivatives, or a solution thereof in a water phase containing an inherently water-soluble polyvinyl alcohol and an organic complex of the Werner type in which a trivalent chromium atom is co-ordinated with a carboxylic acid group having at least 10 carbon atoms, e.g. stearato chromic chloride. Emulsions of this type can be used in the treatment of wood, paper, textile and other materials. C.

**Monoazo Dyes: Production.** B. J. Heywood, A. H. Knight, M. Lapworth and Imperial Chemical Industries Ltd. B.P.558,330 of 29/6/1942:31/12/1943. Water-soluble monoazo dyes suitable for dyeing and printing cellulose acetate rayon, wool, silk, tin-weighted silk, and nylon, are made by coupling a diazotised *p*-aminophenyl-hydroxyalkyl ether sulphuric ester (an aminophenyl sulphatoalkyl ether) which may carry substituents other than nuclear sulphonic, carboxyl, or acidylamino groups, with a phenol capable of coupling and substituted in the 4-position by a hydrocarbon residue containing at least two and not more than eight carbon atoms, which hydrocarbon residue is selected from the groups alkyl, aralkyl, cycloalkyl and aryl. The dyes may also be made by coupling a diazotised *p*-aminophenyl-hydroxyalkyl ether, which may carry substituents other than nuclear sulphonic, carboxyl or acidylamino groups, with a phenol capable of coupling and substituted in the 4-position by a hydrocarbon residue as already defined and treating the monazo compound so-obtained with sulphuric acid or other known agent suited to yield its sulphuric ester. The dyes, in the form of their ammonium or alkali metal salts, are soluble in water and have very good affinity for cellulose acetate rayon, dyeing that material from a slightly acid, neutral or slightly alkaline dyebath in non-phototropic yellow shades which have good fastness to light and are dischargeable. On cellulose acetate rayon they yield yellow prints of good light fastness and of high resistance to sublimation or "marking off," e.g. during steaming. C.

**Mercerising Assistant.** National Oil Products Co. (Harrison, New Jersey, U.S.A.). B.P.558,393 of 25/6/1942:4/1/1944 (Conv. 18/7/1941). A mercerising penetrant composition comprises 90-97 per cent. of a lower phenol, e.g. phenol, cresol, commercial cresylic acids, or xlenols, and 10 per cent. to 3 per cent. of a dialkylated phenol in which the alkyl groups contain 4-6 carbon atoms, e.g. diamylphenol. The composition dissolves in the mercerising bath to produce a stable liquid having a high wetting power which does not diminish during use and storage. C.

**Oilskin: Production.** Courtaulds Ltd., H. J. Hegan and J. K. Berry. B.P. 558,394 of 29/6/1942:4/1/1944. Oilskin of improved tearing strength comprises a fabric woven from multifilament artificial threads, e.g. viscose rayon, in which each filament is not less than eight deniers, and proofed with linseed oil and/or a synthetic resin. C.

**Anthraquinone Dyes: Production.** G. D. Buckley, W. W. Tatum and Imperial Chemical Industries Ltd. B.P.558,433 of 1/7/1942:5/1/1944. Anthraquinone



dyes which are derivatives of 1-amino-4-hydroxyanthraquinone having in the 2-position the group  $-OASO_2X$ , wherein A is a straight chain alkylene radical of 2 or 3 carbon atoms and X is hydrogen or alkali metal or ammonium are made by reacting a 1-amino-4-hydroxyanthraquinone with the group  $-OAOB$  (where B is an alkyl radical) in the 2-position with a sulphonating agent, or by interacting a 1-amino-4-hydroxyanthraquinone having an aryloxy group, or a halogen or a sulphonic acid group, or an alkyloxy group of 1-5 carbon atoms in the 2-position, with a solution of an alkali metal or alkali metal hydroxide in a dihydric alcohol containing 2 or 3 carbon atoms, and subsequently reacting the product with a sulphonating agent and, if desired, isolating the dyes in the form of their alkali metal or ammonium salts. Examples describe the production of the sodium salts of the sulphuric esters of 1-amino-4-hydroxy-2- $\gamma$ -hydroxypropoxyanthraquinone and 1-amino-4-hydroxy-2- $\beta$ -hydroxyethoxyanthraquinone. The dyes give brilliant shades of red, of good fastness to light and washing, on cellulose acetate rayon and also dye animal fibres. C.

**Nylon Fibres: Dyeing.** Courtaulds Ltd. and C. C. Wilcock. B.P.558,586 of 8/7/1942:12/1/1944. The affinity of nylon fibres for dyes is improved by treatment as loose fibres, yarns or fabrics, at a temperature of at least 65° C., with an aqueous liquid containing not more than 70 per cent. of one of the following water-soluble organic aliphatic non-solvents for nylon, namely, monohydric alcohols, monoalkyl ethers of glycols, or dialkyl ethers of glycols. The lower aliphatic monohydric alcohols, and in particular normal butyl alcohol and amyl alcohol, are very suitable. The non-solvent for the nylon can be added to the dye-bath before the fibre is entered, or the nylon fibre can be pre-treated with an aqueous solution of the water-soluble non-solvent. The time of pre-treatment can conveniently be about five minutes and for direct cotton dyes, the maximum effect is attained at temperatures of not less than 80° C., and the dyeing is preferably carried out in the presence of 2-5 per cent. of acetic acid (80 per cent.) on the weight of the material. C.

**Oleoresinous Coating Composition: Production.** E. I. Du Pont de Nemours & Co. and M. E. Cupery. B.P.558,617 of 22/5/1942:13/1/1944. An oleoresinous coating composition of improved drying properties is obtained by incorporating in an oil-modified alkyd resin an  $\alpha$ : $\beta$ -unsaturated ketone of the type of butylidene acetone, phorone or mesityl oxide. The compositions may contain thinners, pigments, dyes, metallic driers, plasticizers, cellulose derivatives, resins, etc. They may be applied to metal, wood, glass, cloth, paper, etc. C.

**Insulated Fabric Tubing Shaping Device.** W. C. Prehler (Cleveland, Ohio). U.S.P.2,324,645. In apparatus of the kind in which impregnated fabric tubing is shaped and given the desired diameter by drawing it over a ball, the ball is of magnetic material and is held in position by an external magnetic field. C.

**Polyvinyl Coating Composition.** Carbide and Carbon Chemicals Corporation. U.S.P.2,324,740. A coating composition that remains liquid on storage comprises a dispersion in aqueous ammonia of a co-polymer of a vinyl compound and maleic acid or anhydride, with a higher polyalkylene glycol in which the OH groups are separated by at least three alkylene radicals joined by O atoms. C.

**Silk Soaking Composition.** E. F. Houghton & Co. U.S.P.2,325,489. The composition consists of (a) a soluble salt of a sulphonated monohydric alcohol fatty acid ester,  $RCO_2R'(-SO_3M)_y$ , where R' is alkyl with 1-10 C atoms, R is the radical of an unsaturated fatty acid having 9-17 C atoms, the ratio of C atoms to ethylenic links in  $RCO_2R'$  is 12:1 to 28:1, M is Na, K,  $NH_4$  or substituted ammonium, and y is 0.2-1, and (b) a polybasic acid plasticizing ester of  $R(OH)_x$ , where R is alkyl or aryl, x is 1-6 and the molecular weight of the ester is at least 150, the ratio of a to b ranging from 1:1 to 19:1. C.

**Cloth Pre-shrinking Apparatus.** F. R. Redman (Yardley, Pa.). U.S.P. 2,325,544/5. (1) A process for shrinking fabrics is characterized by compressively rumpling the material length- and width-wise in the presence of moisture and heat while maintaining it free from tension during and between the repeated rumplings. (2) This claim is for the apparatus. C.

**Vinyl Co-polymer Thermoplastic Adhesive.** Textileather Corporation. U.S.P. 2,325,963. A thermoplastic adhesive composition for union with textiles comprises a co-polymer of vinyl chloride and vinyl acetate (87:13), calcium stearate



as stabilizer, and a substantial amount of dibutoxyethyl phthalate and butoxyethyl stearate as plasticizer. C.

**Nylon and Wool Mixtures: Dyeing with Acid Dyes.** General Aniline and Film Corporation. U.S.P.2,325,972. Mixtures of synthetic linear polyamide fibres and fibres containing amino groups are dyed with acid wool dyes in the presence of soluble aromatic sulphonic, carboxylic or sulphocarboxylic acids. C.

**Wool: Brominating to Reduce Shrinkage.** R. L. Ericsson (to Westvaco Chlorine Products Corp.). U.S.P.2,326,021 of 3/8/1943 (through *Text. Col.*, 1943, 65, 470). Wool is treated at  $< pH\ 2$  and  $< 70^{\circ} F.$  with an aqueous solution of chlorine or bromine containing 0.001-0.05 per cent. available halogen (calculated as bromine). The wool is removed from the solution while the latter still contains  $> 0.001$  per cent. available halogen. W.

**Thermoplastic Laminating Fabric: Preparing for Use.** Celanese Corporation of America. U.S.P.2,326,121, 2,326,128, 2,326,189, 2,326,190. (1) Laminating fabric containing yarns of a thermoplastic rayon is prepared for use by coating it with a plasticizer, leaving it for at least five days, then wetting it with an alcoholic agent capable of dissolving the plasticizer and swelling the rayon, and allowing it to age for at least a further day. (2) The laminating fabric contains a cellulose derivative, and is coated with a water-insoluble plasticizer in the presence of water and then dried. (3) The fabric contains cellulose esters and ethers, is impregnated with a plasticizer, aged for at least 5 days at  $85-160^{\circ} F.$  and then heated at  $250-300^{\circ} F.$  for 10-20 seconds, this removing greasiness. (4) The fabric contains cellulose derivatives and/or synthetic linear polyamides and the plasticizer is an aqueous dispersion of an organic derivative of cellulose. C.

**Chlorinated Resin and Zinc Carbonate Fireproofing Composition.** M. Leatherman. U.S.P.2,326,233. A fireproofing composition contains finely divided zinc carbonate and a chlorinated resin that will evolve hydrogen chloride at temperatures below the decomposition point of the zinc carbonate. C.

**Cellulose Ether and Wax Emulsion: Application in Glazed Finishes.** Dow Chemical Co. U.S.P.2,326,605. A glassy finish on dress goods, resistant to laundering, is obtained by impregnating the fabric with an emulsion of a plasticized cellulose ether softening at  $90-125^{\circ} C.$  and a wax of m.p. above  $50^{\circ} C.$ , drying to remove water and organic solvents, and calendering under friction at a temperature that is sufficient to fuse the cellulose ether. About 0.5-1.5 per cent. of the dry finishing agents are left on the cloth and the proportion of wax is 1-10 per cent. of the weight of cellulose ether. C.

**Formalin: Application in Finishing.** E. I. Du Pont de Nemours & Co. U.S.P.2,327,160. In the treatment of textile fibres with aqueous solutions of compounds of the formula  $A-X-CH_2-Z$ , where A is an alkyl group of more than 7 C atoms, X is O, S or N, and Z is a radical containing water-solubilizing groups, the bath is made up with not more than 8 per cent. of formaldehyde and the pH is adjusted to 4.5-6.5. C.

**Abrasive Wad: Production.** Downy Products Co. U.S.P.2,327,199. A roughly shaped mass of fibre is treated with an abrasive powder suspended in a heat-hardenable binder so that the core is left soft and elastic, partially dried until the binder is tacky, moulded into shape, and baked so as to set the binder hard. C.

**Cotton Wadding Filter Disk: Production.** Johnson & Johnson (New Brunswick, N.J.). U.S.P.2,327,250. A filter disk with normal porosity and absorbency and high resistance to washing comprises cellulosic wadding the surface fibres of which are bonded by treatment with an aqueous solution of an agent that is insoluble in cold water but soluble in hot, containing 0.1-2 per cent. of polyvinyl alcohol. C.

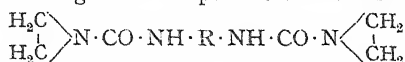
**Nitro-paraffin: Application in Swelling Cellulose Derivatives.** E. I. Du Pont de Nemours & Co. U.S.P.2,327,413. The claim is for a process in which a cellulose derivative structure is swollen with a nitro-paraffin ( $< 6$  C atoms) and stretched. C.

**Leather Substitute: Production.** Tanide Products Inc. U.S.P.2,327,540. Felted cellulosic material is saturated with a solution of a hydrolyzed protein

and tanning materials containing finely dispersed rubber latex, allowed to age, and then treated with a coagulating agent. C.

**Shrunk-finished Cotton Cloth: Production.** Sayles Finishing Plants, Inc. U.S.P.2,327,712. The claim is for a continuous process of shrink finishing in which the cloth is wetted out, mangled, carried forward in loose folds while shrinking occurs, stentered without lengthwise tension, pressed and ironed, and batched. C.

**Ethyleneimino-amido Derivatives: Application in Finishing.** H. Bestian and M. O. Schürman (Germany; vested in U.S. Alien Property Custodian). U.S.P. 2,327,760. Cellulosic materials are given increased strength and resistance to creasing and water, and decreased tendency to splitting, shrinking and swelling by impregnation and baking with compounds of the formula



where R is an aliphatic or carbocyclic radical and at least one H of the CH<sub>2</sub> group is substituted by a hydrocarbon radical. C.

**Wool: Reducing Felting and Shrinking.** E. P. Johnstone, Jr. and W. J. van Loo, Jr. (to Amer. Cyanamid Co.). U.S.P.2,329,622 of 14/9/1943 (through *Text. Col.*, 1943, 65, 515). Wool-containing fabrics are impregnated with an aqueous dispersion of an unpolymerized alkylated melamine-formaldehyde condensate, so that 2-15 per cent. of the condensate on the dry weight of the fabric is absorbed. The fabric is heated to make the condensate water-insoluble. W.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Polyamide Fibres: Chain Length.** H. Staudinger and H. Jörder. *Kunststoffe u. Zellwolle*, 1942, 24, 88-91 (through *Chem. Abstr.*, 1943, 37, 6464<sup>a</sup>). A molecular weight of 12,400 (chain length of 765 links) was found for a condensation product of hexamethylenediamine and adipic acid (nylon) by the viscosity measurement of a dilute *m*-cresol solution according to the equation

$$[Z\eta = \eta_{sp}/c = K_{\text{equiv}}n],$$

in which  $Z\eta$  = viscosity number of nylon fibre in *m*-cresol =  $91.7 \times 10^3$ ,  $K_{\text{equiv}}$  = a constant for polyamide solution in *m*-cresol =  $1.2 \times 10^4$  and  $n$  = number of units in the chain. Since this chain length is relatively short, only about half the length of a viscose cellulose molecule, it is postulated that the much greater strength of nylon fibre derives from large secondary valence forces between the polar CO and NH groups of adjacent chains perpendicular to the fibre axis. The superior properties may also be derived in part from the hot-melt spinning process, since it was found that with highly degraded ethylcellulose a similar process gave fibres of relatively more favourable properties than fibres spun from solutions. C.

**Conditioning Cabinet.** R. Mace. *Textile Research*, 1943, 13, No. 13, 18-20. A conditioning oven for use in research work has been built from a conditioning cabinet, originally used for tyre cord fabric, and a refrigerator unit. The coils from the refrigerator unit are housed in a separate compartment which has a louver front. This is operated by the thermostat system which opens when the refrigerator unit is functioning and closes when the unit stops. The humidification unit consists of a pan to hold water in which a blade fan revolves to pick up particles of water that in turn are blown out from the blade fan by an electric fan operated by the humidification control board. This board is operated by two dry cells through a relay control. The medium of control is operated by sensitized hair. A small electric fan located on one of the inside walls of the conditioning unit keeps the air in the cabinet in complete circulation. The cabinet is also equipped with revolving sample racks for the same purpose. C.

**Fibre Photo-micrographs: Production by Projection.** J. J. Perot, Jr. and C. G. Schultz. *Paper Trade J.*, 1943, 117, TAPPI, 247-248. A simple arrangement for the production of photo-micrographs of pulp fibres and similar materials comprises a light source, a microscope and a printing frame aligned along a common optical axis. Prints are made by projecting the image directly on sensitized paper which is developed after suitable exposure. If desired contact prints may be made in the usual manner from the paper negative. To avoid

the necessity of light-tight apparatus, this equipment is operated in a photographic darkroom, but the work may be carried out under a safelight. A photomicrograph of a beaten softwood obtained by this method shows fibrillation clearly. C.

**Single Fibre Strength Tester.** I. B. Shires. *Instruments*, 1943, 16, 612, 614 and 616. Details are given of an apparatus for determining the tensile strength and elongation of single fibres which includes in its construction a Harvard trip balance of 5 kg. capacity equipped with a clamp to take a vertical round rod and hooks beneath the pan hangers, jaws consisting of two brass or steel plates having their inside faces covered with leather, and an arrangement in which water flows from a bottle to a receiving vessel thereby increasing the load on the fibre at a nearly constant rate. When the fibre breaks, a rocker arm closes a stopcock and the volume of water in ml. which flowed into the receiving vessel is recorded as the load in grams necessary to break the fibre. The fibre is weighed and the breaking length calculated. Results are given for six fibres picked from a single leaf of *Yucca baccata* and tested with a distance of 5 cm. between the jaws. C.

**Fibres: Creep Phenomena.** E. R. Schwarz. *Textile Research*, 1943, 13, No. 13, 2-8. In a review of a book by Leaderman on "Elastic and Creep Properties of Filamentous Materials and Other High Polymers" the author discusses creep and creep recovery in textile fibres, the superposition principle in the deformation of fibres, and the importance of these effects in practical applications of textile materials. C.

**Fibre Mixtures: Analysis.** H. Fehlmann. *Schweiz. Arch. angew. Wiss. Techn.*, 1943, 9, 109-112 (through *Sci. Abstr.*, 1943, 43 A, 213). The method of analysis described is based on flotation in chloroform. The sample is finely divided (0.1 to 0.5 mm.), dried, or its moisture standardized, and a weighed amount is placed in an analytical tube (designed by the author) together with pure chloroform. The tube is stoppered and the behaviour of the material noted. If necessary to produce a separation of the different fibres, the chloroform can be made heavier or lighter by introduction of a suitable solvent. The fibres are thus separated according to their densities, some float, others sink, and the fractions are removed, dried and weighed. Full manipulative details are included. C.

**Correction.** See page A70. Lines 6, 5 and 4 from the bottom should read: "Fibres treated with boiling solutions of 2 per cent. formaldehyde below pH 3 or above pH 9 develop linkages that are stable to boiling for 1 hour in 5 per cent. sodium metabisulphite."

#### (C)—FABRICS

**Fabrics: Examination of Surface Structure.** K. Schwertassek. *Textilberichte*, 1943, 24, 79-81 (through *Chem. Abstr.*, 1943, 37, 6466<sup>2</sup>). The occasional streaky appearance of rayon prints can be studied by pressing a sample of the material slightly moistened with ferric chloride against paper treated with potassium thiocyanate and removing it carefully. The result of the chemical reaction at the points of contact leaves on the paper a picture of the structure of the material. For heavy fabrics ferrocyanide gives better results than thiocyanate. By this method it is possible to detect and study even the finest differences in the structure of fabrics without any interference from their lustre and colour. C.

**Silk-Wool Mixture Fabrics: Analysis.** G. Baroni. *Seta*, 1940, 46, 181-182 (through *Chem. Zentr.*, 1941, 1, 3025 and *Chem. Abstr.*, 1943, 37, 6465<sup>1</sup>). The fabric is finely cut, boiled 15 min. with 1 per cent. soda solution and dried. A 3-g. sample of the dried material is boiled 30 min. with 1 per cent. soap solution, well washed, dried and weighed. The material is then transferred to a 250-c.c. beaker and 100 c.c. of 1.4 per cent. caustic soda containing 6 c.c. of hydrogen peroxide is poured over it. The contents of the beaker are then warmed to 60° and kept at this temperature for 15 min., after which they are transferred to a small filter, washed well, dried at 100°, and weighed. The wool is quantitatively dissolved by this treatment. C.

**Textile Materials: pH Determination.** H. R. R. Wakeham and E. L. Skau. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 616-618. In methods for the determination of the pH of leather, paper and textiles, a single extraction has been

used on the assumption that the amount of water per unit weight of sample is relatively insignificant. Measurements of the effect of concentration on the pH of dilute acid, base and buffer salt solutions, however, indicate that the pH of the extract will be a function of the quantity of water used. The authors define the pH of a textile material as the pH of the water present in the cloth under American standard conditions of temperature and humidity and describe an extrapolation method for its determination. Extractions are made with different quantities of water, the pH values are plotted against volume of water used, and the pH value corresponding to the air-dried condition is determined by extrapolation. Results are given for samples of bleached cotton twill before and after dyeing and other treatments. C.

**Wool Textiles: Quality Control.** B. H. Wilsdon. *Textile Manufacturer*, 1943, 69, 520-521. A report of an address on the inter-relations of systematic testing (leading to "quality control") and sales promotion, with special reference to the creation of "certification trade marks." As an example, the lecturer discussed the possible extension to wool textiles generally of the "Warnorm" mark now being applied by the Ministry of Supply to Service fabrics with the Wool Industries Research Association as certifying authority. C.

**Cloth Yardage Conversion Tables.** Messrs. Block and Anderson Ltd. *Textile Weekly*, 1944, 33, 102. Tables of conversion factors are provided for calculating square yardage from linear yardage for cloths ranging from (1)  $\frac{1}{2}$  to 36 inches in width (reprinted from a previous issue), (2)  $36\frac{1}{2}$  to 72 inches and (3)  $72\frac{1}{2}$ -108 inches. C.

**Nylon Fabrics: Chemical Resistance.** Ruth O. Donohue. *Iowa State Coll. J. Sci.*, 1943, 18, 25-26. A report is given of tests on a sulphur-free nylon fabric (polyhexamethylene adipamide) containing 0.28 per cent. of titanium dioxide and yielding 0.35 per cent. of ash. Mordanting with aluminium sulphate baths, the effects of treatment with dichromate baths under various conditions on weight, chronic oxide fixation, total nitrogen, and wet strength, and the effects of dry heat, boiling water, steam, ironing, exposure to ultra-violet light and treatment with alkali alkyl sulphate, calcium hypochlorite, formaldehyde, iodine, phenol, dichromate, permanganate, sodium hydroxide, and sulphuric acid on wet strength were studied. The results show that nylon materials are resistant to oxidants at room temperature, less resistant to oxidants in the presence of an inorganic acid, quite resistant to dry heat but not resistant to saturated steam at a temperature greater than 138°C., and appreciably degraded by ultra-violet light. C.

**Wool Blankets: Thermal Transmission.** E. Freedman. *Rayon*, 1943, 24, 527-8, 588-9. The object of the investigation was (1) to study the effect of fabric construction and of after-treatment on warmth, (2) to compare relative air permeability with relative warmth, and (3) to study the effect of humidity on warmth. The apparatus used in the thermal insulation tests was a modified form of that described in Proc. Amer. Soc. Testing Materials, 1930, Part II, 1025-1040. Two grades of local (Tennessee) wool were used, 50-54s and 56-58s. Three blankets were in lock, crêpe and plain weaves, and six in twill weave, the latter being tested off the loom, off the dryer, and off the 1st-6th nappers. The following conclusions were drawn:—(1) The finer the wool, the greater the thermal insulation. (2) The higher the count, the greater the thermal insulation. (3) The plain weave provides less warmth than the lock, twill and crêpe weaves. (4) Thermal insulation is increased, in general, by successive nappings. (5) In slowly moving air, increased thermal insulation is accompanied by increased air permeability. (6) The warmth decreases as the wind velocity increases. (7) The warmth decreases as the humidity increases. W.

**Blankets: Calculating Grease Weights by Slide Rule.** G. Wakefield. *Text. World*, 1943, 93, No. 11, 102-103. The construction is described of a simple slide rule for the blanket trade for calculating the greasy weight required to give desired finished weight with known percentage losses in finishing and vice versa. It is suggested that similar rules can be made for other uses involving the calculation of values related to shrinkage. W.

#### (D)—OTHER MATERIALS

**Cresylic Laminated Plastics: Physical Properties.** J. B. Lunsford. *J. Amer. Soc. Naval Engrs.*, 1943, 55, 481-516 (through *Chem. Abstr.*, 1943, 37, 6369<sup>a</sup>). The results of tests made on four types of laminated phenolic materials covered

by American Navy Specification show that the substitution of phenol for cresol results in a lowering of the impact strength, affects the electrical properties, and emphasizes the directional properties of the laminates. C.

**Ethylcellulose Plastics: Properties.** M. Demarest, W. P. Moeller and B. E. Cash. *Modern Plastics*, 1943, 21, No. 3, 101-103, 162, 164. Ethylcellulose plastics are slow-burning and can be extruded dry and moulded by injection as well as by compression and transfer. Their toughness approximates to and in some formulae exceeds that of celluloid at extremely low temperatures. They have the advantage over other cellulosic plastics of lighter weight, lower power factor, improved acid and alkali resistance, and wider solubility in solvents. The use of ethylcellulose for the construction of U.S. army flashlight cases, canteens, Venturi tubes and steering wheels is described and specifications which these articles have to meet are outlined. A report is given of tests on injection-moulded flare cases made from three cellulose acetates, three cellulose acetate butyrates, and five ethylcelluloses. The tests involved (1) immersion for 30 min. in water at 180° F., (2) immersion for 3 hours in water at 180° F., (3) exposure to high temperatures (210° F.) and relatively low humidities for 48 hours, (4) exposure for 24 hours at 175° F. and 0 per cent. R.H., then 24 hours at 175° F. and 75 per cent. R.H., and finally 24 hours at 175° F. and 100 per cent. R.H., and (5) exposure at 195° F. and 100 per cent. R.H. for 24 hours. Photographs and shrinkage data are given. The results show that ethylcellulose is superior to the other materials tested for mouldings which must have minimum dimensional change at high temperatures and humidities, as well as resistance to wet heat. Good results were also obtained in impact tests on the ethylcellulose plastics. C.

**Laminated Plastics and Plywood: Bearing Strength.** James Bond. *Trans. Amer. Soc. Mech. Eng.*, 1943, 65, 9 (through Mark & Proskauer's *Resins, Rubber, Plastics Abstr.*, 1943, Sheet A9:144). The author has measured the load causing (1) a deformation equal to 4 per cent. of the bearing pin diameter, and (2) a permanent set of 0.2 and 1.6 per cent. on specimens of laminated canvas and paper phenolic plastics, molded macerate-filled plastic, and plywoods conditioned for 96 hours at (a) 160° F., (b) 70° F. and 55 per cent. R.H., and (c) 70° F. in water. The results are tabulated. They show that the deformation test is more satisfactory than the permanent set test, that the plywoods are inferior to the reinforced plastics, that heating improves the bearing strength, and that soaking in water definitely reduces the strength. C.

**Plastics: Electrical Properties and Moisture Regains.** *Product Eng.*, 1943, 14, 165. Dielectric constants and power factors at frequencies of 60, 1,000 and 1 million cycles, dielectric strengths at 1 million cycles in a short-time test, and per cent. moisture absorbed in 24 hours are tabulated for (1) phenol-formaldehyde resin with wood flour, fabric, and mineral fillers, (2) phenol-furfuraldehyde resin, (3) a cast phenolic plastic, (4) urea-formaldehyde resin, (5) melamine-formaldehyde resin, (6) polystyrene, (7) cellulose acetate, (8) methyl methacrylate, (9) ethylcellulose, (10) vinyl co-polymer, (11) vinylidene chloride, and (12) laminated phenolic plastics with paper, fabric, and glass base. C.

**Paper Products and Timber: Testing Rot Resistance.** B. Schulze. *Holz Roh-u. Werkstoff*, 1942, 5, 345-350 (through *Rev. Appl. Mycol.*, 1943, 22, 417). Technique for testing the resistance of timber, etc., to decay in hot countries is described. For paper, cardboard and the like the inoculum consists of *Lenzites trabea*, *Poria contigua* and *Comiophora puteana*. The culture dishes are kept at 28° C. and 80 per cent. R.H. The effects are gauged by loss of weight (paper products are conditioned at 20° C. and 65 per cent. R.H.), appearance, and sometimes by strength tests. C.

**Plastics: Structure and Physical Properties.** L. W. Turner. *Chemistry and Industry*, 1943, 62, 492-495. The fundamental deformation processes described by Tuckett are summarised in the form of an equation giving for a constant temperature the relationship between (a) deformation and time, and (b) deformation and stress. Since the state of different plastic materials is different at the same temperature and since temperature itself has a marked influence on the behaviour, the method chosen to determine the relationships (a) and (b) will depend on the state of the material at the temperature of test. In general the method consists of applying, at different temperatures, a stress (whether

tensile, compressive or shearing), and measuring the resulting deformation as a function of time. The limit set upon any particular method is shown diagrammatically, the methods being divided into three groups: (a) static, (b) dynamic, (c) viscometric. A description is given of static methods and the analysis of results of such tests, and dynamic and viscometric methods are very briefly discussed.

**Rubber: Elastic Properties.** H. M. James and E. Guth. *J. Chem. Phys.*, 1943, **11**, 455-481. A simplified model for bulk rubber is proposed that consists of a network of idealized flexible chains extending through the material and a fluid filling it. Two models of the flexible molecular chains are used—one with a linear stress/extension relation (Gaussian chain), the second with independent links of fixed length, having, like real molecular chains, a definite maximum extension. Methods for the statistical treatment of chains of independent links at all extensions are developed and applied to the computation of stress/strain relations for the second of the above models. It is shown that an irregular network of Gaussian chains is equivalent to a simple set of independent chains; the corresponding reduction for non-Gaussian chains is only approximate. With this reduction in all cases, the model is applied to the quantitative computation of stress/strain curves for unilateral stretch of rubber and for stretch in two directions. Elastic properties of rubber in the swollen state, the thermo-elastic properties, the location of the thermo-elastic inversion point, and linear thermal expansion coefficients are studied. Experimental stress/strain curves for bulk rubber at constant temperature are compared with the theory for extensions up to 400 per cent. The agreement is particularly good for that part of the total stress due to changing entropy. Characteristic features of the stress/strain curves are explained. It is estimated that, in the materials considered, roughly one-fourth of the rubber chains are actively involved in the network.

**Rubber: Position on Plastic-elastic Scale.** J. M. Buist and R. C. Seymour. *Trans. Inst. Rubber Ind.*, 1943, **19**, 64-90. Young's modulus and coefficient of viscosity are not sufficient to characterise the deformation of rubber-like materials. New constants are required to describe rubber-like behaviour, which shows a complex dependence upon strain and rate of strain. Analytical and integrative methods are shown to lead independently to this conclusion. The behaviour of rubber-like materials can be described by empirical or derived equations, which contain ideal cases as special solutions. The equation derived by Nutting and by Scott Blair for measurements of firmness of soft materials is applicable to the case of rubber in compression,  $\psi$  is interpreted as stiffness and  $h$  as a measure of the time dependence of deformation, and a new index  $l$  is introduced to describe the changes in state produced by technical processes. A special case of the Scott Blair equation for extension at a constant rate is suggested  $\psi = S\sigma^{-k}\sigma^{k'-1}$  where  $\psi'$  and  $k'$  are constants. The parameters ( $\psi$ ,  $k$ ) of the rubber-like state for natural rubber, Neoprene GN, Butyl rubber, GR-S and Novoplas A in the raw state, and the positional changes induced in these materials by mastication, vulcanisation and reinforcement have been determined. Technical data, such as creep are interpreted on this basis. A method of representing the properties of rubber-like materials by three-dimensional diagrams involving,  $\psi$ ,  $h$  and  $\beta$  is introduced. The uncertainty in measurements of the constants of real materials such as rubber is considered and an explanation offered for anomalous values of  $k$ .

**Rubber-like Materials: Behaviour under Constant Stress and Constant Strain Conditions.** G. W. Scott Blair and B. C. Veinoglou. *Nature*, 1944, **153**, 165-166. Many experimental data have been published substantiating the use of the Nutting equation,  $\psi = S\sigma^{-1}t^k$ , where  $S$  is shear stress,  $\sigma$  is strain,  $\beta$ ,  $k$  and  $\psi$  are constants, when a series of constant stress experiments is performed. For relaxation experiments, test pieces are given a definite strain as rapidly as possible, the resulting internal stress being then allowed to dissipate with no more change of strain than is required to operate a strong spring whose deflections which record the stress, can be read by optical magnification. According to Maxwell's equation, the rate of stress dissipation should be proportional to stress itself, but many authors have shown that this is not so for complex materials. The appropriate fractional differentiation of Nutting's equation gives  $(\partial S/\partial t)\sigma = -(k/\beta).(S/t)$ . Investigations of a number of rubbers and rubber-

like materials in tension and a few in compression have shown, with the exception of some very soft materials, little if any deviation from linearity when  $\log S$  is plotted against  $\log t$  for a series of constant strains. The values of  $k$ ,  $\beta$  and  $\psi$  calculated from constant stress (compensating for the change in cross-section) and constant strain experiments are so nearly the same that differences can scarcely be much greater than experimental error. Typical experimental curves, and derived curves relating stress to strain for a defined time, are given. C

**Tests of Chemical Compounds Against Fabric Insects.** W. Colman. U.S. Dept. Agric., Bur. Entomol. Plant Quarantine, 1942, E 592, 12 pp. (through Chem. Abs., 1943, 37, 6136). Tests were made of 165 organic compounds (13 classes) as protectants of fabrics against the webbing clothes moth (*Tineola biselliella*) and the furniture carpet beetle (*Anthrenus vorax* Waterh.). Small squares of wool cloth were immersed for about 10 min. in a 5 per cent. acetone solution of the compound to be tested and then allowed to dry. Two methods of testing were used. While a number of the compounds were effective against newly hatched larvae of both insects and several were effective against partially grown larvae of the clothes moth, only *p*-bromobenzenesulphonamide, dehydroacetic acid, 2,4-dinitroanisole and 2,4-dinitrophenyl ester of acetic acid either gave complete kills of partially grown larvae of the carpet beetle or were as effective as the standard mothproofing agent (sodium silicofluoride). W.

#### PATENTS

**Stocking Inspection Apparatus.** E. R. Ammon (Reading, Pa.). U.S.P. 2,324,897. Apparatus including a form on which stockings are stretched for inspection is fitted with a mirror for viewing the areas obscured from direct vision. The mirror is retracted while the stocking is being placed on or taken off the form, but swings into inspection position when the stretching device is applied. C.

**Feltable Fibre Testing Apparatus.** Wood Conversion Co. U.S.P. 2,325,026/7. The apparatus consists of two cylinders of different diameters in which known masses of fibre can be compressed at known rates by screwing down pistons, means to record the pressures set up on dial gauges, and means to measure the heights of the columns under load and after releasing the load. These parts are contained in a housing with the ends of the screws outside. Claims for the use of the apparatus are as follows: (1) The "frictional characteristic of a sliding mass of fibre" is calculated from the observed pressures at the same density of packing and the radii of the cylinders. (2) The elastic properties of the fibres are determined by observing the pressures set up at a series of compressions down to the point at which felting begins and also the density after releasing the pressure. C

### 7—LAUNDERING AND DRY CLEANING

#### (A)—CLEANING

**Laundry Soap Builders: Detergent Action and Whiteness Retention.** T. H. Vaughn and A. Vittone, Jr. Ind. Eng. Chem., 1943, 35, 1094-1098. The effect of 0.05 per cent. of various alkaline builders on the detergency of 0.1 per cent. soap solutions was investigated in washing tests at 60° C. with artificially soiled muslin. The order of decreasing effectiveness from the point of view of detergency (removal of soiling matter from fabrics) was found to be proprietary builder 3, sodium hydroxide, proprietary builder 2, proprietary builder 1, sodium metasilicate, sodium carbonate, trisodium phosphate, modified soda, sodium bicarbonate. It is pointed out that equivalent detergent action may be obtained with builders both high and low in detergent action by adjusting the ratio of soap to builder. Whiteness retention (ability of detergent to prevent the deposition of soil on fabrics from a suspension of the soil in solution) was measured at a soap concentration of 0.1 per cent. and a soap builder ratio of 1 to 1. The decreasing order of effectiveness is proprietary builder 2, proprietary builder 1, modified soda, sodium bicarbonate, trisodium phosphate, sodium metasilicate, proprietary builder 3, sodium carbonate, sodium hydroxide. The behaviour of silicates and phosphates is contrasted with that of other builders. It is pointed out that, besides soil removal and whiteness retention, other properties such as water softening action and rinsibility, must be considered when comparing the over-all efficiency of laundry soap builders. C.



**Soap: Economy in Laundering.** A. Chwala. *Fette u. Seifen*, 1942, 49, 253-265 (through *Chem. Zentr.*, 1942, ii, 843 and *Chem. Abstr.*, 1943, 37, 6466<sup>9</sup>). A systematic method of treatment is discussed with particular consideration of the textile fibre, wash water and its treatment, washing assistants, washing operations and processes, and rinsing. Directions are given for washing with synthetic washing agents, such as fatty alcohol sulphonate and enzymes. C.

**Anhydrous Sodium Soaps: Physical States. Sodium Soaps: Physical States; Effects of Glycerol and Oils.** See Section 9.

**Laundry Wastes: Treatment.** J. A. McCarthy. *Public Works*, N.Y., 1942, 73, No. 7, 13 (through *Water Pollution Res. Summary Curr. Lit.*, 1942, 15, 381-382). Laundry wastes studied had high pH values (up to 11), caustic alkalinity at times as high as 1,000 p.p.m., and grease contents of about 267 p.p.m. When the wastes were applied to a trickling filter 8 ft. deep at a rate of 1 mil. gal. per acre per day, a high degree of purification was obtained. The effluent was almost free from turbidity and caustic alkalinity, and grease was reduced to 35 p.p.m. At a rate of application of 1.5 m.g.a.d. satisfactory purification was obtained, but at 10 m.g.a.d. signs of overloading appeared. The filter is now in operation at 5 m.g.a.d. In tests on coagulation with alum by the fill-and-draw method, 23 g. of alum per gal. reduced the average pH to 6.1 and produced a floc which settled rapidly. By the continuous method 23 g. of alum per gal. gave a supernatant liquid with a pH value of 6.3 after settling for 3 hours; turbidity was reduced by 89 per cent., grease content by 84 per cent., and the B.O.D. by 74 per cent. When ferric sulphate was used instead of alum in the fill-and-draw experiments, a dosage of 32 g. per gal. was required and the pH value was reduced to 5.4. Sludge obtained with both alum and iron salts dried rapidly and was not putrescible. The cost of treatment could be reduced considerably by using sulphuric acid in conjunction with alum or ferric sulphate. Other coagulants tested included copper salts, calcium chloride alone or with sulphuric acid, bleaching powder, lime, sulphuric acid, magnesium sulphate, sodium chloride, and ferrous sulphate. Laboratory experiments on coagulation of pure soap solutions with alum showed that the amount of alum required was slightly more than the theoretical amount for formation of aluminium tristearate and slightly less than the theoretical amount for formation of bistearate. The amount of grease extracted from the waste waters by ether increased in proportion to the amount of acid added. After extraction by ether the waste was again made alkaline and coagulated with alum. The amount of alum required was proportional to the amount of grease remaining in the waste so that a large part of the alum used to coagulate the raw waste had combined with the soap. Studies made on recovery of coagulant and soap from the sludge showed that 75-90 per cent. of each could be recovered but the process is not economically practicable. C.

**Wash Liquors and Soil Removal: Influence of pH.** T. H. Vaughn and L. R. Bacon. *Starchroom Ldy. J.*, 1941, Sept., 44, 46, 74-6, Oct. 44, 46, 48, 56. The pH of laundry wash liquors containing soap and alkali drops substantially when the temperature is raised from ordinary to high temperatures. This fall of pH, which is in the order of 1 pH unit is greatest if the soap-alkali ratio is high. Colorimetric determinations of the pH of wash liquors have been found unreliable. Washing tests have been carried out with artificially soiled fabrics using liquors containing a fixed amount of soap and varying amounts of modified alkali. Cleansing as measured both by whiteness and by soil removed increases with alkali concentration up to 0.2 per cent. although the pH is constant. It is concluded that alkali titration is a better criterion for wash liquors than pH measurement. La.

#### (C)—FINISHING

**Collars and Cuffs for Men; Smoothing Rough Edges.** J. F. Miller. B.P. 558,168. Appl. 19/6/1942. Acc. 23/12/1943. This invention relates to smoothing rough edges of men's collars, cuffs and shirt neckbands and also to smoothing the inside of folds of collars to prevent neckties from sticking. The device consists of a cylindrical or pyramidal block, having at one end two slots at right angles to one another. A typical composition for use with this device consists of a mixture of about 49 per cent. of a hard wax, like carnauba wax, about 49 per cent. of a very finely powdered white material substance, such as



French chalk, and a minor quantity of about 2 per cent. of a binding medium such as petroleum jelly. La.

#### PATENTS

**Flat Work Ironer.** U.S. Hoffman Machinery Corporation. B.P. 558,552. Conv. U.S.A. 13/1/1941. Appl. 16/1/1942. Acc. 10/1/1944. The chief object of this invention is to provide a simple flat work ironer with which padding is not needed, nor the employment of mechanical means for securing easily adjusted and uniformly distributed ironing pressure. The machine consists of a stationary ironing member, provided with an ironing plate having a perforated ironing surface, along which the goods are moved by a substantially air-impervious, driven friction belt, a network of criss-cross grooves in the ironing surface in communication with the perforations, and a suction or vacuum chamber arranged behind the perforated surface in such a way that the suction effect at the perforations is distributed uniformly over the entire ironing surface. La.

**Dry-cleaning Solvent: Activation.** Norris Products (Chicago). U.S.P. 2,324,917. Dry-cleaning solvent of the Stoddard type is "activated" for the removal of water-soluble dirt by injecting into it about 0.1 per cent. of its volume of dry steam. C.

**Dry-cleaning Compositions.** Allied Chemical and Dye Corporation. U.S.P. 2,326,772, 2,327,182, 2,327,183. The claims are for emulsions of water in organic dry-cleaning solvents. The emulsifying agent in the first patent is an ammonium, alkali metal, alkaline earth or organic ammonium salt of a sulphonated aliphatic organic compound having an alkyl group of at least 4 C atoms and the  $-SO_3H$  attached to a primary alkyl C atom. In the second patent the agent is a similar salt of a sulphonated aliphatic monocarboxylic ester of a monohydric alcohol having at least 13 C atoms, of which at least 8 are in the alcohol residue. In the third patent the agent is a similar salt of a sulphonated aliphatic dicarboxylic ester of an alcohol having at least 8 C atoms. The amount of emulsifying agent used is not more than 1 per cent. of the weight of solvent. C.

### 8—BUILDING AND ENGINEERING

#### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Cotton Stalks: Use for Production of Boards.** F. W. Z. Burg. *Paper Ind. Paper World*, 1943, 25, 612-615 (through *Chem. Abstr.*, 1943, 37, 6454\*). Experiments on the utilisation of cotton stalks for the production of boards are reported. The total yield of board was about 90 per cent. of the weight of material fed to the hammer mill. The boards had a modulus of rupture of 80-500 lb. per sq. in., the thinner boards showing a higher strength on the average than the thicker ones. The thermal conductivity varied between 0.291 and 0.708 B.t.u. per hour per ° F. per sq. ft. per in. The commercial feasibility of the process is discussed and an estimate is made of the cost of construction and operation of a plant. C.

**Nylon: Injection Moulding.** R. B. Akin and J. E. Teagarden. *Modern Plastics*, 1943, 21, No. 3, 115-120, 166. Uses of injection-moulded nylon, e.g. slide fasteners, and spools for aircraft instrument coils, are briefly discussed. Properties of nylon FM-1 are tabulated and discussed and graphs are given showing the effects of moisture content and temperature on various physical properties. Moulding technique for nylon FM-1 is described, suitable nozzles are shown in diagrams, and certain difficulties and necessary precautions are pointed out. C.

**Resin-impregnated Wood: Applications and Properties.** R. Casselman. *Modern Plastics*, 1943, 21, No. 3, 124-126, 168. "Impreg" is made by impregnating wood, usually veneers, with a synthetic resin solution, drying and then baking at 200-250° F. to set the resin. The treated veneers are usually bonded as with plywood or laminated wood. "Compreg" is made by impregnating, drying, then densifying under heat and pressure with steam platens. The resin plasticizes the wood, holds the plies of veneers together, bonds the fibres together, reduces the rate of moisture absorption and penetration, stabilizes the dimensions, displaces the moisture content equilibrium, increases hardness, reduces impact strength, improves resistance to decay and attack by termites,

and (for phenol resins at least) increases resistance to acids. Types of resins used are discussed in relation to the properties desired in the products, and tables are given showing the properties of Jabroc laminated densified wood, wet and dry flexural strengths of resin-impregnated plywood (not densified), and the properties of birch compreg made with various resins. Applications of resin-impregnated wood are briefly discussed. C.

**(C)—STEAM RAISING AND POWER SUPPLY**

**Boiler Plant: Improving Efficiency.** *Fed. Brit. Ind. Fuel Economy Review*, 1943, pp. 35-38. Seventeen directions are concisely given for improving the fuel efficiency of boiler plant. C.

**Wood Waste: Utilization as Fuel.** P. Harris. *Fed. Brit. Ind. Fuel Economy Review*, 1943, pp. 30-33. The efficiency of wood waste as a fuel is discussed and suitable furnaces are described, with diagrams. They include the Dutch oven, the inclined grate furnace, furnaces for burning in suspension, a hopper-type furnace, and drum stoves. C.

**Coal Saved by Saving Heat: Practical Hints on Lagging.** *Wool Rec.*, 1943, 64, 910-911. Figures are given showing the necessity for lagging, insulation saving as much as 95 per cent. of the heat loss. Insulating material should be kept dry, and should be properly applied to the surface. The use is described of basic magnesium carbonate (85 per cent.), with which is incorporated asbestos fibre (15 per cent.), the magnesia being supplied either in sectional form or in powder form for application as a plastic mixture. It is suggested that valves and flanges should be lagged, as such fittings cause proportionately more heat loss than an equal length of pipe. W.

**Fuel Saving: Efficient Production and Use of Steam.** D. R. H. Williams. *Wool Rec.*, 1943, 64, 874, 877, 879. Suggestions are made for the necessary apparatus and methods to be adopted to obtain maximum efficiency in the production of steam in Lancashire boilers, and for the reduction of waste of steam, particularly in space heating and process work. W.

**(D)—POWER TRANSMISSION**

**Natural Fats: Lubricating Characteristics.** E. M. Kipp. *Mechanical Engineering*, 1943, 65, 809-811. Tests were made with a Falex lubricant-testing machine in which two V-shaped steel test bearing surfaces are pressed against a rotating steel pin. Both bearing surfaces are immersed in an oil cup. Torque and applied-load values are indicated by two gauges. It is assumed that high load-bearing capacities (as indicated by large values of applied loads at failure) and low torque values represent desirable lubricating characteristics. Tables showing failure-load values for 5 per cent. concentrations and torque values for 75 per cent. concentrations (by volume) of typical animal, vegetable and marine fats in mineral oil, and curves showing the variations in failure-load and torque values with concentration of fat are given. Failure-load values increase and torque values, which are directly proportional to frictional resistance, decrease with increasing concentration of fat. The curves for fats of animal, vegetable and marine origin are of similar type. At moderate bearing loads, 5 per cent. additions lower the torque values by approximately one half of the maximum possible net effect obtainable with the straight natural fat. The effects produced by these different types of fats are of about the same order of magnitude. C.

**"Lectralevel" Floatless Control System for Liquid Level.** Londex Ltd. *Text. Rec.*, 1943, 61, No. 727, 56. Details are given of a method for controlling electrical apparatus for pumping out, filling or maintaining the level of a liquid in a container. Only one wire is required between the tank and the relay. Two simple electrodes of different lengths are used to operate the relay, one having a resistance sufficient to hold the relay after it has been operated by the other electrode. The circuit is completed through the liquid, but, the voltage being low, dangerous shocks are impossible. W.

**(F)—LIGHTING**

**Lighting Installations: Thermal Problems.** W. R. Stevens. *G.E.C. Journal*, 1943, 12, 177-186. In all commonly-used electric light sources some 80-90 per cent. of the energy input to the lamps is dissipated as heat. The problems involved in controlling this heat can be divided into (1) heating of the sur-

roundings and, in particular, of people lighted by an installation, and (2) heating of fittings and associated cables. Attempts to reduce the heating effect by the use of high-pressure mercury vapour lamps and high-voltage fluorescent discharge tubes, and by passing light from lamps through several layers of glass or through special heat-absorbing glass are discussed. Methods of measuring surface temperatures of fittings and the examination of convection currents by the "schlieren" method are described. The use of large radiating surfaces, baffles, and ventilated fittings is considered, and heat-resisting insulation, flame-proof fittings, and thermal endurance tests on glassware are briefly discussed. C.

**Light Sources: Colour Designations.** K. L. Kelly. *J. Optical Soc. America*, 1943, 33, 627-632. An extension of the I.S.C.C.—N.B.S. (Inter-Society Colour Council—National Bureau of Standards) system of colour names for the description of the colours of drugs and medicines is proposed for describing the colours of lights. The colour names consist of hue names such as red, pink, yellowish green, or purple without further modifiers since they are intended to differentiate lights, chiefly according to hue. The hue names are among those used in the I.S.C.C.—N.B.S. system and carry the same meaning. The chromaticity ranges identified by each of these hue names are defined by areas on the International Commission on Illumination chromaticity diagram. Comparisons are made between the centres of the proposed hue name ranges and similar values by other authorities, and with the standard colours recognised in various specifications for marine, railway, aviation, and traffic signal colours. C.

#### (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Cotton Mill: Air Conditioning and Dust Collection.** F. Wright. *J. Textile Inst.*, 1943, 34, P145-149. C.

**Thermostatic Control Devices: Industrial Applications.** W. S. Crosier. *Fed. Brit. Ind., Fuel Economy Review*, 1943, pp. 23-37. A broad review of the fuel economies possible by the application of thermostatic control in steam raising, factory heating and processing. Diagrams are given of various systems. C.

**Infra-red Heating Equipment: Application.** *Engineer*, 1944, 177, 71. Synthetic paints and putties which stove at a temperature of 150° F. are being used in aircraft, and heat is supplied for stoving by infra-red radiation. Infra-red heating has two great advantages as a medium for aircraft assembly stoving, as the heat is generated within the paint film and is largely reflected by the metal skin. Thus built-in components which are shielded from direct radiation are at a lower temperature than the paint film itself. Secondly, the generation of heat within the film prevents the formation of a dry surface film trapping solvents in the under-layers. Illustrations of typical plants already installed on full-scale production of fighter aircraft are given together with a table comparing drying times with steam ovens and with infra-red equipment. Temperature control is effected by switching on or off different combinations of lamps. The plant shown is designed to take either a main wing, fuselage, or the leading edge of the wing only, the correct combination of lamps being selected automatically by pressing a button. At the same time an automatic timing device is put into operation which switches out the required number of lamps after a lapse of approximately five minutes when the desired temperature has been reached. The timing device then operates again after a further 5 or 25 minutes, according to whether paint or putty is being dried. Thus the operative has only to select one of five suitably labelled push buttons and leave the plant to complete the process by itself. A clear indication of the completion of the process is given when all the lamps are out. A heating curve for a main wing assembly is shown. C.

**Dusty Air: Examination.** T. A. Eames. *J. Sci. Instruments*, 1943, 20, 169-175. An account is given of the application of physics to various railway problems, including problems of heating, ventilation, dust removal, and noise reduction. A method and apparatus for determining dust concentration, in which a sample of the dust-laden air is passed through a filter paper and the reflexion factor of the darkened paper is measured by a photometric device, and arrangements for determining the efficiency of dust removal and pressure drop—air flow characteristics of filtering materials are described. C.

**(H)—WATER PURIFICATION**

**Iron and Manganese: Removal from Water.** E. W. Moore and E. A. Snow. *J. New England Water Works Assoc.*, 1942, 56, 320 (through *Water Pollution Res. Summary Curr. Lit.*, 1942, 15, 360). Water containing various amounts of manganese and iron was treated with sludges prepared from K permanganate and ferrous sulphate in stoichiometric proportions, with addition of lime, powdered calcium carbonate, or other alkaline agents. The sludge was allowed to remain in suspension in the water for a given time and was then removed by filtration. Iron and manganese in the filtrate were determined by the usual methods. Five types of well water were used. Four other types of sludge were tested, but were not as effective as the above. The latter was therefore used to investigate the effects of time of contact with sludge, aeration, pH value and reagents used to adjust it, age of sludge, and quantity of sludge, on the removal of iron and manganese. Removal of iron and manganese was good even when the mixture was filtered immediately so that the total period of contact did not exceed 15 min. Treatment of the water without sludge by adjustment of pH value, aeration, settling, and filtration removed less than 50 per cent. of the iron and manganese present. Aeration of a mixture of water and sludge did not increase the removal of iron and manganese. Iron is removed at pH values of 7.0-9.0, but is adversely affected by values above 9.5. The optimum pH value for removal of manganese is 8.5-10.0 and at pH values below 7.0 the content of manganese in the water may be increased by solution of manganese from the sludge. Sludge which had been aged by continual use for nearly two months or by storage for 100 days gave as good results as fresh sludge. The quantity of sludge required to reduce the contents of iron and manganese to about 0.1 p.p.m. is 0.6-0.7 g. of dry suspended solids per litre. As raising the temperature to 37° C. increased the removal of iron and manganese, and as the results did not always conform to the Freundlich absorption equation, it is concluded that the process is not one of adsorption alone. The sludge was effective with all types of water and manganese was removed as readily as iron. Tables of results are given and their application to plant practice is suggested. The theory of the mechanism of the removal of iron and manganese is discussed. C.

**Sodium Hexametaphosphate: Effect on Solution of Lead.** E. W. Moore and F. E. Smith. *J. Amer. Water Works Assoc.*, 1942, 34, 1415 (through *Water Pollution Res. Summary Curr. Lit.*, 1942, 15, 361-362). A report is given of experiments in which water was allowed to run through a tube containing lead wool and through a series of tubes containing "Micromet" and lead wool. "Micromet" is a slowly soluble form of sodium metaphosphate and at the rate of flow of water used in the experiments it produced a fairly uniform solution containing 3 p.p.m. metaphosphate. In experiments with tap water (pH 8.8) run continuously through the tubes for 39 days, the effluent water contained 0 to 0.18 p.p.m. of lead in the absence of metaphosphate and about 0.06 to 0.32 p.p.m. of lead when the tap water contained metaphosphate. On all days except one the amount of lead in the water treated with metaphosphate was greater than that in the untreated water. In experiments with filtered water (pH 6.0), taken from the water works before lime had been added, the amount of lead dissolved varied from about 0.2 to 1.3 p.p.m. During the first 9 days the amount of lead in the filtered water treated with metaphosphate was slightly more than that in the untreated water, but it subsequently fell considerably and was below that in the untreated water. The results of experiments using lead pipes which had been exposed to corrosive water until a protective coating had formed agreed in general with those obtained with lead wool, except that after the first few days the amount of lead in water with a pH value of 8.8, after flowing through the pipes, was less in the water treated with metaphosphate than in untreated water. The conclusion drawn from these experiments is that the addition of metaphosphate materially reduces the amount of lead taken up by water with a pH of 7.0 or less, but in certain conditions it may increase the amount of lead taken up by water with a pH of 8.8. As, however, the amount of lead taken up by such alkaline water is very small the increase due to metaphosphate does not constitute a serious danger to health, except possibly where metaphosphate is used in a softening plant as a substitute for recarbonation. In this case the amount of lead taken up by the softened water standing in lead pipes might be considerable. C.

**Sodium Hexametaphosphate: Use in Water Treatment.** O. Rice. *J. New England Water Works Assoc.*, 1942, 56, 84 (through *Water Pollution Res. Summary Curr. Lit.*, 1942, 15, 361). Treatment of water with hexametaphosphate to control corrosion at various American water works is described. With a flow of water of 0.5 gal. per min., treatment of water with 1 p.p.m. and 5 p.p.m. of metaphosphate reduced tuberculation in iron pipes by 50 and 80 per cent. respectively, as judged by improvement in the rate of flow. Tuberculation was greater at high than at low pH values with untreated water and with water treated with metaphosphate. Much less tuberculation occurred in the presence of 1 p.p.m. of metaphosphate at higher than at lower rates of flow, but the opposite occurred with untreated water. This is believed to be due to increased turbulence at higher rates of flow which brings the metaphosphate into more intimate contact with the surface of the pipe. It is concluded that greatest reduction of tuberculation would be obtained with high rates of flow and at low pH values of the water. These experiments confirm conclusions already reached by the author that reduction of corrosion obtained by the use of metaphosphate is due to the formation of a protective film on the surface of the metal and that therefore the results obtained will be proportional to the amount of metaphosphate passing over a given area in a given time rather than to the concentration of metaphosphate. The concentration of metaphosphate required to prevent precipitation of iron in the water of water works supplying over 10, 1 to 10, 0.5 to 1.0, and less than 0.5 m.g.d. is approximately 0.5 to 1, 1, 2, and 4 p.p.m., respectively. A dose at least double the above figures is required at the beginning of treatment and 0.2 to 0.5 p.p.m. metaphosphate should be maintained at all points in the system. If metaphosphate is added to water containing dissolved iron in amount not sufficient to prevent eventual precipitation of the iron, all the metaphosphate is carried down in the precipitate. C.

#### PATENTS

**Humidity Control Device.** H. J. Kaufman (Detroit). U.S.P.2,325,061. The air of an enclosed space is held at constant relative humidity over a wide range of dry-bulb temperature by chemically dehydrating the air to form a waste hygroscopic solution of vapour pressure in equilibrium with that of the air, determining the density of the solution and controlling the rate of drying in accordance therewith, and compensating the control due to density according to the temperature in the enclosure. C.

**Direct-reading Wet-and-dry Bulb Psychrometer.** Jules Crapez (France; vested in the U.S. Alien Property Custodian). U.S.P.2,326,124. The wet and dry bulbs are mounted side by side and flanked by a vertical slider and an oblique slider that carry a thin rod or similar member which is brought by turning screws at the ends of the sliders opposite the tops of the mercury columns in the thermometers. The oblique slider lies alongside a scale of relative humidities and the point where the rod crosses the scale gives the required value. C.

**Sodium Pyrophosphate: Application in Water Softening.** E. I. Du Pont de Nemours & Co. U.S.P.2,326,950. Water is softened by the addition of tetrasodium pyrophosphate followed by borax, Na metasilicate or Na<sub>2</sub>H phosphate. C.

**Purine Bases: Application in Water Treatment.** E. I. Du Pont de Nemours & Co. U.S.P.2,327,323. Hard water is softened by the addition of sufficient pyrimidine, uracil, thymine, cytosine, purine, xanthine, guanine or adenine. C.

#### 9—PURE SCIENCE

**Chlorazol Black E. Fungal Stain.** F. D. Armitage. *J. Roy. Micro. Soc.*, 1943, [iii], 63, 14-19 (through *Rev. Appl. Mycol.*, 1943, 22, 445). A useful stain for the photomicrography of micro-fungi consists of phenol (2), lactic acid (2), water (2), glycerin (1), and sufficient Chlorazol black E to give the mixture the appearance of Indian ink. C.

**Wheat and Barley: Starch Content.** A. G. McCalla and W. G. Corns. *Canadian J. Res.*, 1943, C 21, 307-321. The starch content of six varieties each of wheat and barley grown under a wide range of environmental conditions was determined polarimetrically. Environment had a greater effect on starch content than did variety, but both effects were highly significant. Correlation

coefficients as high as  $-0.970$  were obtained between starch and protein content, and for every variety coefficients were highly significant. Regression of starch on protein yielded coefficients numerically well above  $-1.0$  for both wheat and barley. Barley yielded 16 per cent. more starch per acre, on the average, than did wheat. Yields of starch per acre were highest in grain grown on park-land soils, and lowest in that on prairie soils. C.

**Starch: Colloidal Behaviour and Enzymic Degradation.** P. Diederling. *Z. ges. Getreidewesen*, 1942, 29, 182-184; 1943, 30, 1-17 (through *Chem. Abstr.*, 1943, 37, 6354<sup>8</sup>). The characteristic action of  $\alpha$ - and  $\beta$ -amylases and the effects of their action on the starches of the various cereal flours are reviewed. The amylolytic activity of a flour can be evaluated by investigation of the enzymic starch liquefaction, in a water suspension of the flour, by the amylographic method modified to maintain a constant temperature and an absolute gelatinization capacity (by addition of silver nitrate to inhibit enzyme activity). Comparative studies on wheat, rye and barley indicated an increasing stability of their starches in the order named. Gelatinization capacity is increased in sprout-injured flour which is characterized by increased  $\alpha$ -amylase content. A mixed flour containing 2.5 per cent. sprout-injured flour showed a sharper decline in the amylogram curve but no apparent decline in baking quality; with 5 per cent. of injured flour there was a decrease in the baking quality, particularly with respect to elasticity of the crumb, although further decrease in viscosity, as evidenced by sharper decline in the amylograph curve, was slight. The amylograph, therefore, can only be indicative of flour quality; increased gelatinization capacity should lead to caution in the dough preparation, but only very strong liquefaction (the amylogram curve essentially a straight line) is proof of unsuitability of the flour in a straight yeast dough process. A strongly damaged flour gave a good bake if prepared with baking powder or by the normal yeast process with the addition of baking powder. This result was due to the lowering of the hydrogen-ion concentration in the dough, since the  $\alpha$ -amylase responsible for the starch injury has a very narrow pH zone of optimal activity. An improvement in sprout-damaged grain or flour by destruction of the  $\alpha$ -amylase was accomplished by moist heat (steam) treatment. Even damaged rye flours thus treated could be baked alone (with typical quantities of sugar). The improvement thus effected in wheat and rye baked goods was evidenced particularly by improved elasticity of crumb. C.

**Gas Pressure-regulating Device.** B. R. Warner. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 637-638. A manostat capable of controlling a large range of pressures over a large range of flows is described and shown diagrammatically. A sintered glass disk, a by-pass controllable needle valve, and a mercury column which also serves as a manometer are used on the high-pressure side, and a throttling needle valve on the low-pressure side. The method of operation is explained, and the limiting conditions for use are defined by mathematical equations and graphs. C.

**Hydrogen Electrode Half-cell: Use in Polarography.** J. P. Baumberger and Kathleen Bardwell. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 639-641. The hydrogen electrode serves as an adequate and convenient anode in polarographic work when sufficiently well buffered to remain unpolarized. The quinhydrone electrode, even when rapidly stirred, is less satisfactory for this purpose. The relatively low potentials obtainable with the hydrogen electrode permit the use of low bridge voltages and consequently the spreading of polarographic waves. The electrode potential can be readily adjusted by changing the pH of the solution in which it is immersed. Some improvements of the Sargent type of Heyrovský polarograph are suggested. C.

**Photo-electric Titration Apparatus.** R. H. Osborn, J. H. Elliott and A. F. Martin. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 642-646. A photo-electric instrument which is generally applicable to acid-base and oxidation-reduction titrations employing coloured or fluorescent indicators consists essentially of an arrangement in which a collimated beam of light passes through a cylindrical flask containing the solution to be titrated and impinges on a glass plate set at a  $45^\circ$  angle with the beam of light and the transmitted and reflected light falls on two photo-cells, approximately 8 per cent. of the light passing through the flask being reflected to one barrier layer photo-cell in front of which is a coloured glass filter, and the remaining 92 per cent. being transmitted by the

plate and falling on the other photo-cell in front of which is a filter of a different colour. The filters are selected so that one transmits light in a region of the spectrum where the transmission of the solution with the indicator does not change appreciably upon addition of titrant, whilst the other filter transmits in that region of the spectrum where the transmission of the solution with indicator changes most rapidly upon addition of titrant. The photo-cells are connected with two variable resistors and a galvanometer in a Wheatstone bridge circuit. By means of a third photo-cell which is mounted on the back of the sample compartment with its axis at right angles to the direction of the beam and which is connected in the bridge circuit with one of the photo-cells receiving the beam transmitted by the sample, titrations may be carried out in which the end point is indicated by the formation or disappearance of a precipitate, or by means of a fluorescent indicator. The application of the instrument to the determination of the acid and saponification numbers of dark-coloured resins is described in detail. A precision of  $\pm 1$  per cent. is easily obtained. C.

**Boric Acid: Volumetric Determination.** H. Schäfer and A. Sieverts. *Z. anal. Chem.*, 1941, 121, 161-169, 170-183 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 284). (1) Metals interfering with the usual titration of boric acid are removed by precipitation with 8-hydroxyquinoline dissolved in dilute caustic soda. Excess of reagent is removed by means of magnesium chloride solution and animal charcoal. Normal amounts of alkali and alkaline-earth metals need not be removed. Data showing satisfactory recoveries in the presence of Zn, Pb, Al, Fe, or Ni are recorded. (2) Methods are described for titrating boric acid with alkali free from carbonate in the presence of invert sugar or mannitol, using methyl red or bromocresol purple as indicator. The invert sugar method is not interfered with by  $\text{NH}_4$ , Zn, Ni, Cd, Co, Mn and  $\text{AsO}_3$  ions or small amounts of silica, phosphoric acid and arsenic acid; Al, Fe, and Pb ions must be previously removed by means of 8-hydroxyquinoline. Large amounts of silica can be eliminated, without loss of borate, as silica gel, under the conditions described. Application to the determination of boric acid in silicates is outlined. C.

**Copper: Determination with Dithizone.** G. H. Bendix and Doris Grabenstetter. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 649-652. Details are given of a method for the rapid colorimetric determination of Cu, in which the Cu is extracted by means of dithizone solution along with the other metals which react at a pH of 2.3 (Pt, Pd, Au, Ag, Hg, Bi, and  $\text{Sn}^{II}$ ), and then separated from these metals by shaking the extract with 2 per cent. potassium iodide solution acidified with hydrochloric acid and decolorised with sodium thiosulphate. The copper remains in the carbon tetrachloride layer as the dithizonate whilst the other metals are extracted as iodide complexes. Recoveries of better than  $\pm 0.3 \mu\text{g}$  can be obtained by this method. Applications of the method to the determination of copper in foods, steel and solder are described and the results are compared with those obtained by other methods. C.

**Fluoride: Colorimetric Determination.** N. A. Talvitie. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 620-621. Details are given of a procedure for the colorimetric determination of fluoride in natural waters containing not more than 1,000 p.p.m. of any one of the common ions, which depends on the change in colour of a thorium-alizarin lake on addition of fluoride. By applying small corrections, results may be obtained to 0.1 p.p.m. of fluoride with the use of a 100 ml. sample. Phosphate and aluminium interfere, but their presence may be recognised in the course of the determination. The method excels previous colorimetric methods in speed, accuracy, and stability of reagents. C.

**Stannous Salts: Determination with Mercuric Chloride.** J. G. Fairchild. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 625-626. Tin can be determined by weighing the mercurous chloride formed on adding stannous chloride to mercuric chloride. With pure tin solutions the procedure is rapid and accurate and is applicable over a range from 0.1 to over 70 per cent. tin. Procedures applicable to concentrates, cassiterite ores, and ores containing complex tin sulphides are described. C.

**Tin: Determination by Titration with Methylene Blue.** E. Wohlmann. *Z. anal. Chem.*, 1941, 121, 161-173 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 286). Attack's method for determining stannous tin by titration with



methylene blue has been investigated and compared with the titration with iodine solution. Iron, which is unsuitable, and zinc or aluminium have been compared as reducing agents for stannic ion in hydrochloric acid. Tungstate, vanadate and molybdate ions interfere with the methylene-blue titration and must be absent. Any lead or other metal precipitated by aluminium during reduction of the solution containing tin must be removed, and the reduction repeated. Alkali, iron and nickel in amounts resulting from a sodium peroxide fusion of tin ores do not interfere. C.

**Titanic Ion: Reduction in the Jones Reductor.** I. Baumfeld. *An. Asoc. Quim. Brasil*, 1943, 2, 9-12 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 286). Determination of titanic ion by reduction with amalgamated zinc (Jones), oxidation by ferric ion, and titration with permanganate yields results in agreement with the gravimetric method. The effect of varying the rate of reduction and other conditions is described. C.

**Cereals: Moisture Content Determination; Use of Control Salts.** E. A. and R. Schmidt. *Z. ges. Getreidew.*, 1942, 29, 70-73 (through *Chem. Abstr.*, 1943, 37, 6355<sup>9</sup>). For checking the efficiency of drying ovens in laboratories doing collaborative work on moisture in cereals, it is suggested that parallel determinations might be made of the water of crystallisation of a suitable salt. Barium chloride fulfils the requirements, providing not more than 1.3 g. is used for a test sample. Copper sulphate and calcium sulphate are sensitive to changes in relative humidity and vapour pressure, and therefore not satisfactory for the purpose. C.

**Methylcellosolve Vapour: Determination.** H. B. Elkins, E. D. Storlazzi and J. W. Hammond. *J. Ind. Hyg.*, 1942, 24, 229-232 (through *Brit. Chem. Physiol. Abstr.*, 1943, A III, 837). A differential dichromate method of oxidation for determination of methylcellosolve vapour in the presence of ethyl or methyl alcohol is described. Acetone interferes, but can be removed by aeration. *iso*-Propyl alcohol, ethylcellosolve, and probably other water-soluble solvents of low volatility interfere. C.

**Oil: Determination in Water.** C. A. Noll and W. J. Tomlinson. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 629-632. Sources of error in the determination of oil in water samples due to (1) the presence in the oil residue after evaporation of substances other than oil, e.g. inorganic salts, and (2) the separation of oil from the water sample on standing are discussed, and data are presented showing the magnitude of the errors with various methods of oil determination. Such errors can be avoided by the use of a procedure in which the sample is fixed immediately on collection by adsorption of the oil on a ferric hydroxide precipitate and the oil is subsequently extracted from the washed and dried precipitate. Results obtained on solutions of oil in distilled water and on boiler water samples by the various methods are compared. C.

**Organic Halogen and Alkoxy Groups: Semi-micro Determination.** T. White. *Analyst*, 1943, 68, 366-368. Apparatus for use in the semi-micro determination of alkoxy groups by the alkalimetric method of Zacherl and Krainick, or of halogen by the volumetric method of Viebock and Brecher, is described and shown diagrammatically. Details are given of procedures for accurate and rapid consecutive determinations. C.

**Phenols: Colour Reactions.** A. Steigmann. *J. Soc. Chem. Ind.*, 1943, 62, 208. It is pointed out that in the test for phenols described in a previous paper the reagent used was actually *p*-phenylenediamine hydrochloride (not *p*-aminodiphenylamine). The test cannot be applied directly to the detection of phenols in gelatin owing to the presence of inhibitors; one of these collects in the distillate and has been identified as sulphurous acid. Details are given of a procedure in which hydrogen peroxide is used to remove sulphites. In the absence of phenol the test can be used for the detection of sulphurous acid in gelatin distillates. C.

**Cellulose: Oxidation with Periodic Acid.** G. Goldfinger, H. Mark and S. Siggia. *Ind. Eng. Chem.*, 1943, 35, 1083-1086. Purified cotton linters and cellulose regenerated from cuprammonium solution were oxidised with potassium metaperiodate solution at a pH of less than 1 (sulphuric acid). Curves showing the oxygen consumed as a function of time are given and explained by assuming that the sample consists of more easily and more difficultly accessible



areas. Estimated amounts of easily accessible (amorphous) material are purified cotton linters 6 per cent., regenerated cellulose dried from water 7.4 per cent. and dried from benzene 19.5 per cent., and commercial cotton samples 1.0-2.1 per cent. Curves showing aldehyde groups present, carboxyl groups present, and total oxygen consumed during the oxidation of the linters are compared. The aldehyde curve first follows the total oxidation, reaches a distinct maximum after about 16 hours, and declines later so that almost no aldehyde groups can be found experimentally after 24 hours. The carboxyl curve starts rising slowly, reaches its steepest part where the aldehyde concentration is highest, and follows closely the total oxygen consumption as soon as all the easily accessible material is used up. The mechanism of the reaction is discussed and expressions are deduced for the number of aldehyde and carboxyl groups present at each instant. C.

**Cellulose, Sugar and Coal Carbonisation Products: Properties.** G. Milner, E. Spivey and J. W. Cobb. *J. Chem. Soc.*, 1943, 578-589. An account is given of a study of the properties of the solid product of carbonisation (coke) from cellulose (filter paper and cotton wool), sugar, coals of different types, anthracite, petroleum, coke, etc. The specific gravity reached approximately 1.4 at 500° and 1.8 at 800°, with very slight further change with increase in temperature at 1200°. The absence of progress to 2.25, the specific gravity of graphite, is attributed to gas (which escapes very slowly) between the layers of graphite crystallites. The essential identity of the molecular structure formed from different substances throughout the range 800-1200° may be obscured by differences in superficial graphite films although these are too thin to affect the specific gravity appreciably. Oxygen remaining in the substance carbonised is held responsible for the subsequent gasification from 500° upwards of nuclear carbon, and for the formation of an intimately pervasive micro-capillary system indicated by adsorption of carbon dioxide. The terminations of these capillaries at a surface increase its rate of gasification and the reactivity of the coke. Hence, there is a causal connection between oxygen content of the material carbonised, micro-porosity or adsorption of carbon dioxide by a coke and its reactivity, and these often lie in the same order, but not necessarily so. Increasing the surface of a coke by carbonising it with admixed inert material increased reactivity, but not adsorption. The micro-capillarity developed in carbonisation reached a maximum at 800-1000° and then diminished at higher carbonisation temperatures. The influence of soda and other inorganic materials on reactivity is discussed. C.

**Cellulose Hydrate: Conversion to Natural Cellulose.** T. Kubo. *Kolloid Z.*, 1940, 93, 338-345 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 277). X-Ray diagrams indicate that cellulose hydrate and its derivatives are converted into natural cellulose on heating in polar liquids, such as glycol and glycerol. The effect of cooling at various rates on the transformation has been investigated. The hydrate was heated to 250° with glycerol, and then cooled by water at 0°, solid carbon dioxide, liquid air, or slowly (8 hours) to room temperature, or at the normal speed to room temperature. These different treatments did not greatly affect the degree of transformation of the hydrate as indicated by X-ray diagrams. The mechanism of the transformation and the stability of natural and hydrate cellulose are discussed on the basis of the thermo-chemical and electrokinetic behaviour of these compounds. C.

**Nitrocelluloses: Solubility.** M. Wadano. *Kolloid Z.*, 1940, 93, 324-338 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 345). Nitrocelluloses (2.8-13.28 per cent. N) were prepared by nitrating cotton linters with nitric acid mixtures of varied composition. The solubilities were determined in methyl alcohol, ethyl alcohol (absolute and 95.5 per cent.), propyl alcohol and isobutyl alcohol, methyl, ethyl and butyl acetates, acetone and methyl ethyl ketone, and in mixtures of 10 per cent. of camphor in ethyl alcohol, 20 per cent. of camphor in isobutyl alcohol, acetone-benzene, and ether-alcohol. The solubility is independent of the viscosity or degree of polymerisation if this is less than 100-150. Below this limit the solubility increases with decreasing viscosity. The solubility changes can also be explained on the basis of the ratio of the NO<sub>2</sub> groups to the OH groups produced by the hydrolysis of the nitrocellulose molecule. In the alcohols and acetic esters the solubility is generally the smaller, the smaller is the effect of the OH groups compared with the hydrocarbon

groups. With high-N nitrocellulose dissolution commences when the concentration of one of the components of the solvent mixture exceeds a certain limiting value. For low-N compounds the solubility depends largely on the concentration of one of the components of the mixture. The N content for these two solubility limits is 10.5-11 per cent. for mixtures of acetone and benzene, camphor and alcohol, and ether and alcohol. There is a linear relationship between N content and the lowest acetone concentration in acetone-benzene mixtures for complete dissolution. In the case of high-N nitrocelluloses there is a hyperbolic relationship between the lowest camphor concentration in camphor-alcohol mixtures for complete dissolution, and a similar relationship holds for the ether concentration in ether-alcohol mixtures. There is also a hyperbolic relationship between the maximum ether concentration in ether-alcohol mixtures for complete dissolution of the low-N nitrocelluloses. C.

**Nitrocellulose Solvents.** A. Kraus. *Farben-Ztg.*, 1941, 46, 643-644, 663-664 (through *Chem. Zentr.*, 1942, 1, 112 and *Chem. Abstr.*, 1943, 37, 6453<sup>7</sup>). The higher alcohols do not dissolve nitrocellulose. Mixed aliphatic-aromatic ethers exhibit swelling and dissolving powers depending on the nature of the aromatic group. Pure aromatic ethers do not dissolve nitrocellulose. Ethers of multi-valent phenols show distinct solvent power. For each grade of nitrocellulose there is an optimum ratio of alcohol and ether. For nitrocellulose of low nitrogen content an increase of the alcohol content above the optimum ratio is not so unfavourable as an increase of the ether content. The solvent power of the alcohols is increased greatly by the addition of ethers in general. For each alcohol there is an optimum ratio of alcohol/ether for which the solvent power is a maximum. C.

**Plasticised Nitrocellulose: Properties and Constitution.** M. Wadano. *Kolloid Z.*, 1940, 93, 103-109 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 353). The mechanical properties of nitrocellulose plasticised with dibutyl phthalate, camphor or castor oil have been examined and compared. The existence of a complex in solid solution and with definite solubility has been demonstrated for celluloid prepared with the first two plasticisers, the properties of the complex strongly influencing those of the celluloid. With castor oil a solid solution with limited solubility and no complex formation was observed. The ability of plasticisers to alter the form of the valency chains in nitrocellulose, thereby modifying its properties is discussed. C.

**Starch: Action of Caustic Soda.** C. Dumazert and R. Michel. *C. r. Acad. Sci.*, 1942, 214, 645-647 (through *Chem. Abstr.*, 1943, 37, 6487<sup>1</sup>). If starch is pre-treated with aqueous caustic soda, degradation by sulphuric acid-ethyl alcohol is arrested and hydrolysis by pancreatic amylase is much slower, thus suggesting a greater stability of certain intramolecular linkings. C.

**Starch: Constitution and Properties.** K. H. Meyer. *Textilberichte*, 1943, 24, 125-129 (through *Chem. Abstr.*, 1943, 37, 6486<sup>8</sup>). A discussion of the constitution of starch, amylose and amylopectin, properties of amylose and amylopectin and their derivatives, enzymic degradation, the reaction of starch with iodine, the fine structure of the starch grain, swelling phenomena and starch paste, and the differences in the physicochemical behaviour of starch paste. C.

**Starch: Hydrolysis and Phosphoric Acid Content.** M. E. Pronin. *Zapiski Voronezh. Sel'skokhoz. Inst.*, 1940, 19, No. 1, 177-183 (through *Khim. Referat. Zhur.*, 1941, 4, No. 6, 53-54 and *Chem. Abstr.*, 1943, 37, 6486<sup>9</sup>). The velocity of saccharification of starch by diastase is related to the content of phosphorus within each group of plants investigated (various kinds of rye, spring wheat and winter wheat). A 30-min. treatment of starch with 0.2 per cent. hydrochloric acid solution dissolved 0.0347-0.1945 mg. of phosphorus per g. of starch. An inverse relation between the hydrolysability of starch and the amount of soluble phosphorus was observed. C.

**Gelatins: Aldehyde Content.** A. Steigmann. *J. Soc. Chem. Ind.*, 1943, 62, 206-208. The well-known aldehyde colour reactions with benzidine, o-dianisidine, or 2:7-diaminofluorene on the one hand, and resorcinol-hydrochloric acid on the other, when applied to the study of gelatins, give valuable indications as to the nature and treatment of the particular gelatin raw material. The aldehyde present in certain gelatins is most probably hydroxymethylfurfuraldehyde derived from amino-sugars or glycuronic acid, which are

parts of the molecule of hyaluronic acid or chondroitinsulphuric acid, known to be present in hides, cartilage and certain bones. The mechanism of the formation of aldehyde in the process of manufacturing gelatin is unknown. The most efficient laboratory method of producing the aldehyde is to incubate a suitable gelatin for 1-6 days at 37° and at pH 7.0-7.3. The formation of aldehyde in incubated gelatins (pH 7.0-7.3) is inhibited by hydrogen peroxide but not by phenols, and appears to be due to the action of bacteria or enzymes. C.

**Ketonic Solvents for Vinyl Resins.** R. W. Quarles. *Ind. Eng. Chem.*, 1943, 35, 1033-1043. The use of ketones as solvents for vinyl resins is discussed. Non-cyclic ketones are adequate solvents for the vinyl chloride-acetate resins of 88 per cent. vinyl chloride content and having an apparent molecular weight of 10,000, but ketones of stronger solvent power such as isophorone, are more practical with the high-chloride resins and with the vinyl chloride polymers. Solvent studies, by the viscosity-phase diagram method, have been used to evaluate a number of ketone solvents with Vinylite resin VYHH, a vinyl chloride-acetate copolymer containing 85-88 per cent. vinyl chloride. Phase diagrams and curves showing the variations in viscosity of solutions in various ketone solvent-diluent mixtures with composition of the mixtures are shown and discussed. The effect of temperature is also discussed. With certain solvent-diluent mixtures, the viscosity curves pass through minima. These results are interpreted as indicating selective solvation of resin by the active solvent. The order in which solvents of a mixed thinner contact the resin has a marked effect on the viscosity of the resulting solution of the higher-molecular-weight vinyl resins. C.

**Nitroparaffin Solvents: Uses.** R. L. Ericsson. *Ind. Eng. Chem.*, 1943, 35, 1026-1030. The author discusses the properties of nitromethane, nitroethane, 1-nitropropane and 2-nitropropane and their use as solvents, particularly for cellulose acetate-butyrate and acetate in lacquers. Evaporation rates of various solvents and of latent solvents which are activated by nitroparaffins are indicated. Mixtures containing nitropropanes, ethyl alcohol and butyl alcohol are satisfactory solvents for lacquers based on cellulose acetate. The concentrated lacquers may be thinned to spraying viscosity with toluene. Nitroparaffins are also solvents for the vinyl copolymer resins, particularly those made from vinyl acetate and chloride. A mixture containing 75 per cent. toluene and 25 per cent. 1-nitropropane yields a 20 per cent. Vinylite VYHF solution having the same viscosity as one containing 40 per cent. toluene and 60 per cent. methyl isobutyl ketone at the same resin concentration. The nitroparaffins are latent solvents for cellulose triacetate and permit the formulation of solvent mixtures containing only small amounts of chlorinated hydrocarbons. They are also useful for reducing the gelling tendencies of alcoholic zein solutions and as solvents for the synthetic rubber, Hycar OR. C.

**Petroleum Solvents: Properties and Uses.** E. M. Toby, Jr. *Ind. Eng. Chem.*, 1943, 35, 1044-1047. Natural hydrocarbon fractions or petroleum naphthas are classified into aliphatic and naphthenic, aromatic, and "close-cut" petroleum solvents, and the sources, nature, production, properties and uses of each type are discussed. Tables of specifications and uses, and charts showing evaporation rates are given. C.

**Anhydrous Sodium Soaps: Physical States.** W. Galloway and I. E. Puddington. *Canadian J. Res.*, 1943, 21 B, 202-210. Density/temperature and differential cooling curves were determined for sodium stearate and sodium oleate. The genotypical or unidimensional melting point of sodium stearate at 70° C., found by Thiessen, was corroborated. A large transition was noted at about 100° C. and it is suggested that this phase transition is due to a melting in a second dimension at right angles to the molecular axis. A further large transition was found at 125°-130° C. leading to a plastic state in the soap, and it is suggested that this transition point denotes the essential completion of bidimensional melting of the lattice. No further considerable phase change was found up to about 200° C., when disruption of the polar bonds probably occurs to effect complete disruption of the lattice to the liquid crystalline state. Only the latter transition point was found for sodium oleate at about 135° C. C.

**Sodium Soaps: Physical States; Effect of Glycerol and Oils.** W. Galloway and I. E. Puddington. *Canadian J. Res.*, 1943, 21 B, 211-218. The effect of glycerol and of polar and non-polar mineral oils on the density/temperature

relations of sodium stearate and sodium oleate have been measured. A non-polar oil has no effect, and may be regarded as an inert diluent. Glycerol and polar oils are similar in their effects on the physical states of the soaps. Up to the unidimensional melting point of the soap, the polar solvents have no effect. Above this point, however, an increasing effect is obtained with increase in temperature and with amount of solvent. The effect is particularly marked above the plasticity point but may be large also in the region of the bidimensional melting point of the soap. In the presence of glycerol or polar oils the sharp transition of complete melting to a liquid crystal state disappears and the soap is completely melted at temperatures far below the melting point of the soap alone. The orientating effect of the non-polar hydrocarbon chain on the polar grouping of the soap in the presence of a polar solvent is discussed. The influence of excess acid and alkali in the soap is considered. C.

**Acetylated Paper Pulp. Effect of Acetylation on Water-binding Properties.**

W. H. Aiken. *Ind. Eng. Chem.*, 1943, 35, 1206-1210. In confirmation of the results obtained by Bletzinger, the physical strength of sheets prepared from samples of rag stock beaten in the Lampén mill increased with increasing acetyl content, reached a maximum, and dropped sharply with further increasing acetyl content. The acetylated rag stock fibres showed a maximum hygroscopicity at acetyl contents between 3 and 4 per cent. The fact that the hygroscopicity maximum occurred with samples which had undergone no beating and even no disintegration seems to show that the mere opening of the micellar structure by acetylation suffices to increase the number of accessible free hydroxyl groups. The hygroscopicity maximum coincided with the maximum in strength properties as produced in sheets prepared from the beaten acetylated samples. This coincidence would be expected if the maximum in strength properties is regarded as the result of maximum hydration. The previously-observed compatibility of the acetylated rag stock with acetone, as well as the fact that sheets of excellent physical properties and resistance to water and ink could be prepared when acetone instead of water was the medium during beating, was confirmed. Commercial bleached sulphite pulp (Mitscherlich type) showed a behaviour with increasing acetyl content, when beaten in water or in acetone, very similar to that of the acetylated rag stock. Moreover, a maximum in strength properties was also obtained with sheets prepared from samples which were merely subjected to disintegration in the British disintegrator in the presence of water, i.e. without actual beating. The addition of acetylated xylan to unacetylated rag stock failed to produce the improvement in strength properties observed with the addition of unacetylated xylan to rag stock, and the addition of a large amount of (unacetylated) xylan to highly acetylated rag stock failed to improve the properties of the latter. These results seem to support the hypothesis that the strength-increasing effect of added xylan is brought about by mutual bonding between its hydroxyl groups and those of the cellulose. C.

**Membranes; Diffusion through —.** L. Asher. *Biochem. Z.*, 1940, 306, 96-107 (through *Brit. Chem. Physiol. Abstr.*, 1943, A III, 838). Experiments with H, K, Na, Mg, Cl, Br, I, and  $\text{PO}_4$  ions, water, glucose, urea and alanine show that the diffusion of ions and compounds through collodion and sheet cellulose membranes is accompanied by production of heat. With electrolytes, the amount of heat diminishes with the dissociation constant. Still less heat is produced during diffusion of non-electrolytes. C.

**Aniline-Formaldehyde Resin Solutions: Viscosity.** W. Scheele. *Kolloid Z.*, 1940, 93, 1-19 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 353). Viscosity measurements on toluene solutions of various types of aniline-formaldehyde resins are recorded. Up to 10 per cent. of resin, viscosity increases linearly with concentration in most cases. Between 40° and 90°,  $\log 1/\eta$  is proportional to  $1/T$ . The relative viscosity ( $\eta/\eta_0$ ) is greater than that predicted by Einstein's law, deviations from the law being greatest at the lower temperature. The relative viscosity decreases as the proportion of aniline in the resin decreases. Deviations from the law are greater for red resins prepared at about 200° than for yellow resins prepared at lower temperatures. C.

**Pigment-Oil Suspensions: Viscosity Determination.** F. Wachholtz and W. K. Asbeck. *Kolloid Z.*, 1940, 93, 280-297 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 288). Theories of flow of true and anomalous liquids, and methods

of determining viscosity are summarised. Three types of viscometer were investigated for the determination of viscosity at various shearing velocities for pigment-oil suspensions. A rotating-disc viscometer gives bad results owing to frictional temperature rises. A falling-sphere viscometer with a narrow space between sphere and wall of vessel showed that small quantities of suspended pigment favoured turbulent flow. A horizontal band viscometer is suitable for the determination of the viscosity of suspensions for high rates of shear. C.

**Colour Lakes: Fading.** A. N. Neergard. *Ingeniøren*, 1942, 50, No. 73, K81-86, No. 86, K115-116; 51, No. 4, K1-2 (through *Chem. Zentr.*, 1942, ii, 1744 and *Chem. Abstr.*, 1943, 37, 6463<sup>4</sup>). Colour lakes derived from basic triphenyl-methane dyes (especially Methyl Violet and Brilliant Green), precipitated with poly-acids of molybdenum and tungsten are about 100 times more resistant to light than the corresponding tannin lakes. The fading appears to be a photochemical oxidation, in which the light-absorbing material is oxidised. The relation between light-sensitivity and surface concentration and photochemical fading was studied, and the oxidation-reduction potentials were determined. If the dye is represented by F, precipitated acid in the oxidised form by  $S_{ox}$  and in the reduced form by  $S_{red}$ , the following reactions illustrate the oxidation-inhibiting action of the acid:  $FO_2 + 2S_{red} = 2S_{ox} + F$ ;  $2S_{ox} + h\nu = 2S_{red} + O_2$ ;  $2S_{ox} + 2F^I = 2F + 2S_{red} + O_2$ . This action increases to a maximum with increasing normal potential for the reaction  $S_{ox} \rightarrow S_{red}$ . C.

**Drawing-office Photo-printing Papers: Sensitometry.** H. Heywood. *Engineering*, 1944, 157, 21-24. A useful discussion of the various types of negative and positive papers available for drawing-office reproductions, with measurements of their relative sensitivities or rates at which they are affected by light of a given intensity. The following data are tabulated: (1) Relationship between transparency, opacity and "density" for 1, 2, 3 or 4 sheets of tracing paper; (2) Relative sensitivities of 12 types of paper under mercury-vapour light; (3) Opacities of five papers, of an Indian ink film, and of hard and soft pencil films. Conditions for reproducing pencil drawings to the best advantage are suggested. C.

**Fluorescent Dyes: Ultra-violet Absorption in Solution.** K. Chowdhury and C. Bose. *Indian J. Physics*, 1943, 17, 43-49 (through *Brit. Chem. Physiol. Abstr.*, 1943, A1, 271). The ultra-violet absorption has been investigated on the fluorescent dyes succinylfluorescein and pinakryptol-yellow (in glycerol) and acriflavine, succinyleosin, pinaflavol, aniline-orange, rose-Bengal, and pinakryptol green (in alcohol). There was scarcely any change in the absorption curves on the addition of potassium iodide to the first three dyes, which indicates that quenching takes place by collisions of the second kind between molecules of dye and ions of added salt. C.

**Dyed Materials and Blood: Dichroism.** W. D. Wright. *Nature*, 1944, 153, 9-12. "Dichroism" includes changes in hue of the following types: (1) the apparent yellowing of blood on dilution with water, (2) the differences shown by some dyed materials when viewed in daylight and then in artificial light, and (3) the different undertone of a pigment when greatly extended with white. The theory of dichroism is discussed and it is shown that whilst certain visual factors are involved, the phenomenon has an essentially physical origin which is revealed when calculations are made to determine the spectral composition of the light that reaches the eye. C.

**Electrical Instruments: Variation with Humidity.** R. F. Field. *General Radio Experimenter*, 1943, 18, No. 3, pp. 1-4. The effects of high relative humidity on insulation and consequent erratic behaviour of electrical instruments are explained and precautions taken in the design of new instruments are described. Unless instruments are housed and used under standard air conditions, it is advisable to keep records of humidity as well as temperature. C.

**Sodium Laurate and Palmitate: X-Ray Diffraction.** O. E. A. Bolduan, J. W. McBain and S. Ross. *J. Phys. Chem.*, 1943, 47, 528-535. Fibre photographs of the super-curd, sub-waxy, and waxy-crystalline phases of sodium laurate and sodium palmitate are described; each is the most stable phase over a definite region of temperature. The existence of the transition curd  $\rightleftharpoons$  super-curd at about 70° C. for sodium laurate is indicated, as already established for the myristate, palmitate, stearate and oleate. The main changes in the X-ray

diffractions of the laurate and palmitate with increase in temperature are discussed and it is pointed out that certain changes could be explained by a diminution in the value of the monoclinic angle due to an increase in the tilt of the long molecules towards the basal plane. The "crystal forces" that hold the molecules together along the *b* direction, which also corresponds to the fibre axis and which corresponds to the thickness of the parallel paraffin chains, appear to be far more prominent than the forces acting at right angles to them, namely, along the *a* direction or in the plane of the zigzags of the hydrocarbon chains. This would explain the strong tendency towards fibrillation shown by the soaps and the fatty acids and the fact that the whole process of fibre formation may take place in only a few moments. C.

**New World Cottons: Amphidiploid Origin.** S. G. Stephens. *Nature*, 1944, 153, 53-54. Cytological evidence suggests strongly that New World cottons have been evolved by amphidiploidy from hybrids between Asiatic and American diploid cottons. Phenogenetic evidence leading to the same conclusion is presented. Phenogenetic studies of the action of the leaf-shape alleles on the development of the leaf have led to the suggestion that the joint action of an entire (unlobed) leaf gene from the American diploid parent and a lobed leaf allele from the Asiatic parent might reproduce a type of leaf development which is characteristic of New World cottons. In other words, the New World allelomorph series might be regarded as a series of Asiatic alleles acting in conjunction with an entire leaf gene at the other locus. No duplicate leaf-shape genes are known in New World cottons, so it was postulated, on this hypothesis, that the entire leaf gene is quite stable and common to all New World cottons. Crosses between Asiatic and American diploid cottons very rarely set viable seeds, but two hybrids have so far been obtained and their leaves show a marked resemblance to two New World leaf types. Four American diploid species with entire leaves still exist: *G. aridum*, *G. armourianum*, *G. klotzschianum* (including *dauidsonii*) and *G. raimondii*. General morphological considerations suggest that either of the two last-named in combination with *G. arboreum* would produce a hybrid showing considerable similarity to present-day New World cottons. C.

**Triple Species Cotton Hybrid: Meiosis.** S. G. Stephens. *Nature*, 1944, 153, 82-83. Meiotic studies of a triple species hybrid, *G. barbadense* × *G. arboreum* × *G. sturtii* demonstrate, under identical cytological conditions, the low homologies existing between Asiatic, New World, and *sturtii* genomes. Hence *G. sturtii* may be dismissed as a possible parent in the origin of New World cottons. This result considerably strengthens Skovsted's hypothesis that New World cottons originated by amphidiploidy from crosses between Asiatic and American parents. C.

**Aerobic Cellulose-decomposing Organisms: Isolation and Action.** W. H. Fuller. *Iowa State Coll. J. Sci.*, 1943, 18, 39-41. Cellulose dextrans insoluble in water and ranging in average chain length from 75 to 25 anhydroglucose units were prepared by hydrolysing cellulose in cold 72 per cent. sulphuric acid for  $\frac{1}{2}$  to 5 hours and were used for the isolation of some aerobic mesophilic cellulose-decomposing bacteria from soil. The cultures included three species of cytophaga, five cultures belonging to the genus *Cellulomonas*, and one culture classed in the order of *Myxobacteriales*. Except for the cytophagas and one culture of the genus *Cellulomonas*, the organisms were capable of utilising a wide variety of carbon sources, including simple sugars, glucose, xylose, maltose, galactose, and more complex substances such as starch, cellulose, hemicellulose, pectin, and calcium gluconate. The decomposition of filter paper, cornstalk cellulose and jute cellulose by the organisms was studied. All the cultures decomposed isolated plant cellulose far more extensively than extracted cellulose low in xylan, or filter paper. The portion of the xylan associated with cellulose that was most easily extracted by alkali was preferentially decomposed by all cultures and promoted the attack on the true cellulose, whereas the portion of xylan that resisted removal by prolonged acid and alkali treatments also resisted biological attack and was removed only concurrently with the cellulose. This indicates that the influence of the xylan on cellulose decomposition is as much a matter of the nature of the xylan as the amount. Possible explanations of the resistance of a small portion of xylan to both acid hydrolysis and biological attack are suggested. Preferential attack on about 70 per

cent. of the xylan in cornstalk cellulose, and the fact that, when alone, decomposition of true cellulose is difficult to initiate unless large mass inoculations are used, indicate that the initial attack on cellulose may not be energy-yielding, thus supporting the theory that this attack is hydrolytic and not oxidative. In addition, the results indicate that the exoenzyme system is rather restricted and becomes active only when the organisms are in close proximity to the fibre. The mechanical and physical properties of plant material and the architectural arrangement of plant constituents in natural fibres are therefore of utmost importance in decomposition. Lignin retards the decomposition of cellulose, especially when present in large amounts. C.

**Copper Fungicides: Soluble Copper Content and Activity.** R. L. Wain and E. H. Wilkinson. *Ann. Appl. Biol.*, 1943, 30, 379-391. The soluble copper in freshly prepared 4:4:50 Bordeaux mixture was about 7 p.p.m. but on standing in the absence of air this fell to 0.7 p.p.m. after 10 days. The dried deposit on glass plates yielded about 0.5 p.p.m. of copper to water. With increasing alkalinity, the soluble copper in freshly prepared Burgundy mixtures decreased to a minimum of about 3 p.p.m. and then rose again. This effect was not observed with dried deposits which yielded consistently less copper to water. The amounts of copper dissolved by water from dried 4:4:50 Bordeaux deposit on runner bean leaves were slightly greater than from the same deposit on glass plates. Suspensions of *Neurospora sitophila* spores and the filtrates therefrom dissolved copper from dried 4:4:50 Bordeaux deposit in excess of the amount dissolved by water. Steam sterilization of spore filtrates had little effect on their capacity to dissolve copper from dried 4:4:50 Bordeaux. The temperature at which spores were suspended in water was a factor, though the substances capable of dissolving copper were rapidly yielded to water. The nutrient agar on which the fungus was grown influenced the amount of soluble solids in the spore filtrate and the capacity of these filtrates to dissolve copper from dried Bordeaux deposit. Study of the solvent properties of solutions of pure chemical substances of many types showed that copper could only dissolve from dried 4:4:50 Bordeaux deposit by a mechanism involving complex formation. Active substances included amino-, hydroxy-, and certain dicarboxylic acids and their salts, all possible constituents of spore exudate. The results obtained with carbohydrates indicated that such substances are not involved in the liberation of soluble copper from this fungicide. A mechanism of the fungicidal action of copper is suggested which assumes that copper dissolves from the deposit under the influence of excretions from the fungus spore and that the cupri-complexes produced are the means by which soluble copper is transported to the spore wall. Dissociation of these complexes then makes it possible for the active toxicant to be removed by the spore, thus enabling any reversible reactions involved to continue. C.

**Fungicides: Action; Effect of Water.** A. F. Parker-Rhodes. *Ann. Appl. Biol.*, 1943, 30, 372-379. Theoretical deductions are made from the application of the theory of variability to hydration effects, concerning the effect on the variability of a given population of spores to acid and alkali toxication, of varying the isotopic composition of the hydrogen. In acid toxication, variability should decrease and in alkali toxication increase with increasing deuterium content. It is predicted that depolymerization of the water should decrease the variability of a given population of spores to any strongly hydrated ion, such as metallic cations. Experimental techniques are described for applying *in vitro* methods of exact toxicological investigation to solutions containing excess deuterium. The results of experiments verify the theoretical deductions. Exploratory tests bearing on the effect of depolarization of the water gave inconclusive results. The importance of hydration effects in practice is stressed. Evidence is adduced that non-toxic electrolytes exert a direct "desolvative" action on hydrogen ions. C.

**Waxy Maize Phosphorylase: Nature and Action.** Laura Bliss. *Iowa State Coll. J. Sci.*, 1943, 18, 16-18. Activity tests on waxy maize at different stages of development, using glucose-1-phosphate as substrate, showed that phosphorylase is most abundant in the early corn, when starch synthesis is first starting, and that the concentration of the enzyme decreases as the corn kernel develops.



Concentration of the phosphorylase was brought about by precipitation with ammonium sulphate and the conditions necessary to give an enzyme precipitate in which the greatest part of the original activity of the extract was retained were determined. Investigation of the polysaccharide synthesized by the action of the enzyme indicated that during short periods of digestion at room temperature small amounts of straight-chain amylose were formed. Apparently the larger proportion of the synthetic product in such cases was amylose of varying chain lengths. During digestion at a higher temperature or with more active enzyme, larger amounts of polysaccharide were synthesized. However, the greater part of this polysaccharide was of the amylopectin or branched type. It is suggested that short amylose chains may be formed first in the synthesis and that many of these may later be brought together forming a branched structure. It is concluded that the waxy maize phosphorylase comprises two enzymes capable of synthesizing 1:4- or straight chain linkages, and 1:6- or branched chain linkages, respectively. C.

**Potatoes and Sweet Potatoes: Starch Content.** H. N. Barham, G. Kramer and G. N. Reed. *J. Agric. Res.*, 1943, 67, 395-406. Starch contents of 18 samples of potatoes and 18 samples of sweet potatoes were determined by the direct acid hydrolysis method and the diastase hydrolysis method of the Association of Official Agricultural Chemists. The results are tabulated and discussed and varietal differences are pointed out. Studies on the relative effectiveness of cold storage and shed storage for potatoes showed that the decrease in starch was about the same in both, namely, between 4 and 5 per cent. in a period of 6 months. Moisture loss of the shed-storage sample amounted to about 35 per cent. of its original weight as compared with a loss of about 11 per cent. for the cold-storage sample. The starch content of late-harvest potatoes was decidedly lower than that of either regular- or early-harvest potatoes. No pronounced difference was observed in the last two groups. When the crop weight loss of early-harvest potatoes is considered, it is obvious that a certain stage of maturity must be reached before harvesting. Comparison of starch contents of potatoes grown on different types of soil gave inconclusive results. C.

**Starch Components: Characterisation.** J. F. Foster. *Iowa State Coll. J. Sci.*, 1943, 18, 36-38. The molecular size of corn amylose, as calculated from osmotic pressure measurements, is 250 glucose units. The molecular weight of corn amylopectin is estimated to be at least four times as great as that of corn amylose and probably much larger. The viscosity/concentration behaviour of amylose resembles very markedly that of known linear polymers giving added evidence of the linear nature of amylose. Synthetic starch shows increased polymer-polymer interaction, possibly due to the presence of polar groups in the molecule. In spite of its much higher molecular weight corn amylopectin has only a slightly higher limiting viscosity than corn amylose. This suggests a more compact structure for amylopectin, probably branching. The Staudinger equation relating intrinsic viscosity and molecular weight cannot be expected to hold for amyloses and the equation  $[\eta]_{sp}/c]_{c=0} = 0.07 + 1.2 \times 10^{-4} n^{1.6}$  is suggested,  $n$  being the number of glucose units in the chain. The molecular weights of the various amyloses as calculated from this equation are tabulated, together with the potentials at which the materials take up iodine in the titration procedure. There is obviously a close relationship between the affinity for iodine and the chain length. To explain this a new concept of the stability of the amylose-iodine complex is presented, viz., that it is due primarily to resonance interaction between iodine molecules oriented end to end in the amylose helices. This picture further explains qualitatively the intense blue colour of the complex. Partial precipitation of amylose with iodine shows that the latter tends to saturate the amylose molecules successively rather than distributing uniformly as would be expected if the stability were due to interaction between amylose and iodine. Differences in molecular size of corn amylose prepared by different methods are pointed out. Viscosity and osmotic behaviour indicate that waxy maize starch is essentially pure corn amylopectin. Evidence is quoted in support of an essentially spherical, three-dimensional, netlike rather than herring-bone type of branched structure for waxy maize starch (and hence corn amylopectin). C.



**Cross-linked Polymer Networks: Swelling.** P. J. Flory and J. Rehner, Jr. *J. Chem. Phys.*, 1943, 11, 521-526. The interaction of solvents with cross-linked network structures such as occur in vulcanized rubber is subjected to a statistical mechanical treatment based on the model and procedure presented in the preceding paper. The activity of the solvent is expressed as a function of its concentration in the swollen network, and of the degree of cross-linking. The maximum degree of swelling of the network in contact with the pure solvent is related to the degree of cross-linking. The heat of interaction of the solvent with the network can be calculated from the temperature coefficient of maximum swelling. The theory leads to the conclusion that the swelling capacity should be diminished by the application of external stress. Furthermore, the modulus of elasticity should decrease inversely with the cube root of the swelling volume. C.

**Imperfectly Flexible Chains: Statistical Treatment.** H. M. James and E. Guth. *J. Chem. Phys.*, 1943, 11, 531. In their theory of the structure of rubber the authors have reduced the problem of computing the stress-strain relation for bulk rubber to that of determining the effective stress-extension relation for a single flexible molecular chain with ends separated by a distance comparable to its total length. For qualitative and even semi-quantitative development of the theory it was sufficient to represent the molecular chain by a model consisting of independent links of fixed length taking on all orientations in space with equal statistical weight. For the quantitative development of the theory it is desirable to use a model of the molecular chain giving a better approximation to reality. Perhaps the simplest such model is a chain of links of fixed length, each making a fixed valence angle with its neighbours and permitting free relative rotation of two parts of the molecule about its axis. Notes are given on the mathematical methods employed in the statistical treatment of this type of flexible chain under thermal agitation. C.

**Rubber: Statistical Thermodynamics.** F. T. Wall. *J. Chem. Phys.*, 1943, 11, 527-530. A basic postulate used by Treloar and by the author in recent theories of rubber elasticity is re-examined and its equivalent is derived from more fundamental considerations. The postulate dealt with the distribution of molecular lengths in a sample of strained rubber. The equations of state for rubber-like materials are derived by using the conventional methods of statistical mechanics. The results are found to be equivalent to those obtained by other methods. C.

**Solids: Cohesion; Influence of an Adsorbed Layer.** C. Benedicks and P. Sederholm. *Nature*, 1944, 153, 109-110. Measurements of the cohesion at the contact surface between two paraffin cylinders, brought into contact under a definite pressure, showed that previous exposure of the surfaces to tempering reduced the cohesion. This result is attributed to the presence of an adsorbed layer. Similar tests on lead in which the cut surfaces were brought together (1) as soon as possible after cutting and (2) after a definite period permitting the air to form a thin foreign layer on the surfaces, showed that the foreign layer diminished the cohesion. With tin surfaces, increase of exposure time produced a striking decrease of sticking power, indicating that even an extremely thin adsorbed layer strongly diminishes cohesion with solid tin. C.

**Vibrating String: Boundary Value Problems; Resolution by Means of Finite Fourier Transformation.** H. K. Brown. *J. Applied Physics*, 1943, 14, 609-618. Some fundamental properties of the finite sine transformation and the finite cosine transformation are set forth. The finite sine transformation is applied to a problem in the general vibration of a string and a resolution is effected by the introduction of a fundamental set of solutions of the homogeneous transformed problem. An inversion in closed form is accomplished by the use of "Faltung" theorems (involving compositions of two functions). A formal verification of this solution is given as well as a short survey of the applicability of the finite Fourier transformation to problems in engineering and physics. C.

**Vibratory Motion: Characteristics.** S. R. Williams. *Instruments*, 1943, 16, 597-601. A review of vibratory motion, giving an account of demonstrations of the difference between simple harmonic motion and other vibratory motions, of simple harmonic motion of translation, simple harmonic motion of rotation, a harmonic curve, simple harmonic motion and projection of uniform circular

motion, Lissajou's figures, and maximum and minimum positions of velocity and acceleration in simple harmonic motion. C.

**Water Adsorption Isotherm of Wool: Analysis.** J. B. Speakman. *Trans. Faraday Soc.*, 1944, 40, 6-10. The water adsorbed by wool appears to be of three types, viz.,  $\alpha$ -water, which combines with hydrophilic side-chains with great evolution of heat; loosely bound  $\beta$ -water, which is responsible for the fall in rigidity of wool during water adsorption, and is associated with the peptide groups of the main protein chains, combination being complete when each peptide group is associated with one water molecule; and water condensed in capillary spaces at relative humidities greater than 80 per cent. W.

#### PATENTS

**Corn Starch: Separation from Gluten.** Corn Products Refining Co. U.S.P. 2,325,250. The crude starch is subjected to a series of centrifugal operations in which the underflow moves from centrifuge to centrifuge in one direction and the overflow in the opposite direction, combined with concentrating operations on the underflow to increase the density of the starch liquor. A flow sheet is reproduced. C.

**Visual Colour Comparator.** Howard Smith Paper Mills Ltd. (Montreal). U.S.P. 2,325,350. A light integrating sphere has an opening for holding a specimen and a standard side by side, an opening at the opposite end of the diameter for the viewing eyepieces, and an intermediate opening for the light source. Between the lamp and the sphere are two adjustable filter holders, each having one clear opening and two or three filters; in one holder the filters approximate to north skylight and noon sunlight, and in the other holder the filters are red, blue and green. C.

**Viscosity-controlled Starch Conversion Apparatus.** Stein, Hall & Co. U.S.P. 2,325,573. Part of the reaction mixture in the main cooking chamber is circulated from one part of the chamber to another by a pump under control from a viscosity-sensitive device which is set to come into play at a pre-determined viscosity, and means controlled by the same device exercise control over the reaction when the desired viscosity is reached. C.

**Hydroxyalkylcellulose Esters: Production.** Carbide and Carbon Chemicals Corporation. U.S.P. 2,327,397. A hydroxyalkylcellulose obtained from unmercerised cellulose is esterified with a monocarboxylic acid anhydride in a volatile diluent with the help of a catalyst, and the primary, insoluble ester is hydrolysed to an acyl content of 46-54 per cent. calculated as acetic acid. C.

#### 10—ECONOMICS

**Cotton Sheetting: Weaving Costs and Allowances.** *Textile Weekly*, 1944, 33, 61-64. Order No. 49 under the Cotton Control governs cotton sheettings from 66-100 inches wide, woven with not less than 80 ends per inch of 10's-40's or 20's/2-40's/2 warp and not more than 100 picks per inch of 8's-50's or 20's/2-40's/2 weft, in plain or 2 x 2 twill weave. The allowances and margins for arriving at the loom-state selling price are assembled in a set of convenient tables. C.

**British Cotton Industry: Reconstruction.** Cotton Board Committee. *Textile Weekly*, 1944, 33, 124-128. A summary is given of the main conclusions in the Report of the Cotton Board Committee to inquire into the Post-war Problems of the Cotton Trade. C.

**British Cotton Industry: Reconstruction.** W. H. Slater. *Textile Weekly*, 1944, 33, 86-8, 130-134. A report of a criticism and discussion of the recommendations for the reconstruction of the cotton industry put forward by the United Textile Factory Workers' Association. C.

**"Why Wool is Best."** (1) H. F. Tomalin. *Wool Rec.*, 1943, 64, 841. (2) H. I. Aspinall, *ibid.*, 909. (1) The hygienic qualities of wool fabrics are briefly stated. Large-scale advertising of the advantages of wool for clothing, etc., is urgently needed to combat the development of synthetic fibres improperly called "synthetic wool." (2) "Synthetic wool" is an impossibility. Synthetic fibres are useful to produce effects, but they are an adulterant and do not improve a wool blend. The need is stressed for immediate joint action to bring these facts before the public. W.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY AND EDUCATION

**American Quartermaster Board: Organisation.** M. R. Wainer. *Rayon Textile Monthly*, 1943, 24, 429-430, 495-6, 545-7. A report of an address, explaining the organization of the American Quartermaster Board to undertake field and laboratory tests and to initiate research on products for the Quartermaster Corps. C.

**Institute of Textile Technology, U.S.A.: Organisation.** *Cotton (U.S.)*, 1943, 107, No. 9, 78-79. This new organisation, established on August 6th, 1943, "will engage in fundamental and applied research in the interests of the owners of cotton type spindles and/or looms." Membership is open to "American corporations whose principal investment is in cotton mill type machinery." The subscription is at the rate of 10 cents per spindle "in place," or 25 cents per bale of cotton or rayon staple (500 lb.) consumed in the 12 months previous to application for membership, or 0.05 cent per lb. of cloth produced in the previous 12 months. The director is Mr. Ward Delaney, formerly with the Institute of Paper Chemistry, and, before that, a banker. C.

**American Textile Research Organisations: Development.** *Textile Research*, 1943, 13, No. 11, 2-5. A report on plans for linking the activities of the Textile Research Institute, Inc., with one of the outstanding universities is briefly discussed. It is intended to raise a fund of \$2,000,000 at the rate of \$300,000 a year for a five-year period, plus a capital sum of \$500,000. Activities will include fundamental research on all the major fibres, both natural and synthetic, applied research in each of the major branches of the textile industry, economic research, information service of timely and topical importance, and graduate training in cooperation with a university. The advantages of cooperative industry-wide research are pointed out. The economic research committee of Textile Research Institute, Inc., is discussed. The chief function of this committee is to recommend to the Institute important projects in economic research and to supervise their carrying out. C.

**Indian Cotton Operatives: Absenteeism and Wages.** V. B. Kotdawala and H. P. Oza. *Indian Textile J.*, 1943, 53, 397-400. Labour statistics for Ahmedabad (monthly, 1932-1942) and Bombay (yearly averages, 1939-1942) are tabulated and graphed. The authors draw the inference from them that, allowing for such passing events as strikes, threats of air raids, etc., the incidence of absenteeism is directly equated to the cost of living bonus granted since 1940. They appear to despair of teaching the operatives to use the bonus on more food, sanitation and education, instead of liquor, cinemas and the like and advocate a system of deferred payments. C.

**Synthetic Resin Glues: Skin Hazards.** L. Schwartz, S. M. Peck and J. E. Dunn. *Publ. Health Rept., Washington*, 1943, 58, 899-904 (through *Bull. Hygiene*, 1943, 18, 928). The risk of dermatitis through using synthetic resin glues for laminating wood and fabrics has been investigated in seven war factories. In one, employing 800 workers, 600 cases were reported in the first six months. In the acute stage erythema, oedema, vesicles and oozing are observed. Treatment is simple, involving soothing applications. Facilities for frequent washing, the use of clean overalls daily, wearing impervious gloves, and good ventilation are considered to give better results than protective ointments. C.

**Dermatitis and Toxicity Tests.** *Textile Research*, 1943, 13, No. 12, 25. In the patch test at least 50 persons wear for a minimum of four days in contact with the skin a swatch of fabric to be tested or a swatch of harmless cotton impregnated with the chemical in question. After four or more days the patches are removed and the skin observed for irritation. The inconveniences of this test are the delay and the cost. The dermatitis test consists of injecting intradermally into rabbits an extract of the fabric or a solution of the suspected substance. This test is accurate and speedy and the cost nominal. In the toxicity test, the substance is injected intraperitoneally in mice or rats; if the animals do not die within a few hours the chemical is considered safe. This test is accurate, rapid and inexpensive. C.

**Industrial Research: Wider Aspects.** J. W. Waterer. "*Times*" *Trade & Eng.*, 1944, 54, No. 959, 9. The author suggests that scientific research alone is not the key to all the problems of the future and that Britain has failed even

more in the field of enterprising development than in that of invention. What British industry needs, perhaps even more vitally at the moment than a great increase in scientific research, is a body of trained specialists one of whose tasks is to think out the implication of each new invention, unhampered by tradition based on materials and methods of other days, and to achieve the greatest measure of intelligent development of finished products. With such an approach each new discovery or invention can be made to serve the needs of mankind with complete fitness for purpose. Another and equally important function of this specialist or industrial designer is to ensure that in every product of the factory perfect function, which is not so difficult to achieve, is allied to beauty of form, which is not so simple a matter. As a result of industrialization of countries hitherto regarded by British manufacturers as good markets, these markets will no longer be open for the commonplace or mediocre, which they will produce themselves, and trade with them will depend on goods of better quality combining mechanical efficiency with good design. No adequate training facilities have yet been provided for the industrial designer. To a large extent design research can be undertaken by a central trade unit analogous to that of the Cotton Board's colour, design and style centre and the research department of the International Wool Secretariat. A third, and equally vital attribute of progressive development is market research. This is primarily the function of a trade organisation and the machinery of the export groups would appear to be ideally suited to its promotion. It should include a detailed study of each market and of right methods of selling, presentation, packaging, advertising, shipping, etc. All such development schemes should be regarded as educational in character. Their success or failure depends upon the extent to which private enterprise makes use of them. C.

**Institute of Textile Technology.** W. Delaney. *Canadian Text. J.*, 1943, 60, No. 23, 37. The Institute of Textile Technology has been organised by 29 United States textile companies and incorporated in the State of Virginia as a "not for profit" corporation. Like the Institute of Paper Chemistry it aims at combining education and research at the graduate level, its objectives being the training of men for the industry, the granting of scholarships, the collection and dissemination of scientific information, and the prosecution of fundamental and applied research. W.

**Control of Occupational Anthrax: Steam-disinfection of Animal Hair.** E. Hailer and K. Heicken. *Zentralbl. Bakt. I. Abt. Orig.*, 1941, 147, 209-232 (through *Biol. Abs.*, 1943, F, 17, *Abs. No.* 22069). Two commercial types of steam-disinfector used for the treatment of bales of animal hair were tested by observing the temperature attained by a thermal element carried on a "spear" which was thrust into the bales. The "spear" also carried a capsule containing anthrax spores, the viability of which was tested at the end of each trial. Bales of hair from various animal species from 20 sources were examined. The type of apparatus was a double-jacketed chamber into which steam under pressure was led through a reducing valve so that temperatures up to 108° C. were recorded. The usual method had been to sterilize for  $\frac{1}{2}$ -1 hr. with the thermometer at the exit tube recording 104° C. This gave very unreliable results, as the temperature in the centre of the hydraulically packed bales often failed to reach the required temperature and the spores remained alive in 72 of 127 tests. The recommendations are that the hair should be unpacked and placed in wire baskets in layers not deeper than 50 cm. Sterilization at 104° C. for 40 min. was then effective. The unbaling and filling of the sterilizers increase the danger to the workers, so that the use of protective clothing for the exposed parts must be rigidly enforced. The masks and other coverings may be placed in the sterilizer at the end of the filling procedure. W.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### LIST OF ABTRACTORS

The Abstracts in this section of the "Journal" are supplied by the following Organisations, and the source indicated by the initials hereunder shown.

British Cotton Industry Research Association	...	...	...	C.
British Launderers Research Association	...	...	...	I.a.
Bureau of Hygiene and Tropical Diseases	...	...	...	T.
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Imperial Bureau of Plant Genetics	...	...	...	C. or L.
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In this Section the abstractors give digests of reports published in technical and scientific periodicals of the whole world. The opinions and claims expressed in the abstracts are those of the original authors and it must be understood that the staff of the Textile Institute do not necessarily endorse them.

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL.

**Follicle Group in Merino Skin: Development and General Histology.** H. B. Carter. *Australia: Council Sci. Ind. Res., Bull.* No. 164, 1943, pp. 5-21. The pre-natal development of the follicle group is in eighteen clearly-marked stages, which are grouped into three main periods, namely: (a) pre-trio period (stages 1-3), (b) trio period (stages 4-7) and (c) post-trio period (stages 8-18). The pre-trio and trio periods comprise the primary or photophase, the follicles initiated during this phase forming the basic trio groups. These primary follicles are readily distinguished in post-natal life by certain accessory structures, namely: (a) a simple coiled sudoriferous gland of the apocrine type, (b) a bifurcated involuntary muscle, the m. *arrector pili*, and (c) a large bi-lobar or multi-lobular acinous sebaceous gland. The post-trio period constitutes the secondary or neophase, the only accessory structure associated with these secondary follicles being the sebaceous gland, which is small, generally uni-lobar, and may even be absent. Since some few follicles do not conform to this grouping, the composition of the follicle population is best indicated numerically either as the ratio of primary follicles to the total population, or as the percentage of primary follicles present in the total population. The fundamental cleavage of the follicle population of the skin in the merino, as in other sheep, into primary and secondary categories, does not seem to have been sufficiently appreciated by scientific workers. W.

**Study of Follicle Population Density: Use of Tanned Sheepskin.** H. B. Carter. *Australia: Council Sci. Ind. Res., Bull.* No. 164, 1943, pp. 23-38. An examination of six tanned sheepskin skivers for variations in the density and arrangement of the follicles over the skin surface showed the existence of two main gradients, the dorso-ventral gradient and the less important main antero-

posterior gradient. Subsidiary gradient fields were also observed, the most important being those of which the axillary and inguinal areas formed the centres. The best single estimate of the mean density of the follicle population in the skin is likely to be found at a point lying 7.9 in. lateral to the median dorsal line and equidistant from the most medial points on the margins of the axillary and inguinal areas; on the living animal, its location is 7.9 in. lateral to the median dorsal line and 5.7 in. posterior to the line of the heart-girth. W.

**Skinfolds and Wrinkles in the Merino: Arrangement, Nomenclature and Variation.** H. B. Carter. *Australia: Council Sci. Ind. Res., Bull.* No. 164, 1943, pp. 39-59. The economic importance of skinfolds and wrinkles is reviewed. Attention is drawn to the vagueness and inadequacy of current descriptive terms. An anatomical description is given of neck, body and breech folds. Since there is often wide divergence among merino sheep in different countries, it is suggested that photographic type standards be developed as a visual aid to any other descriptive or quantitative method of classification employed. Such a series is presented tentatively in three photographic plates of nine types separately for neck folds, for body folds and wrinkles, and for breech wrinkles. It is considered probable that the types presented, though not entirely satisfactory, will cover the main variations in skinfolding likely to be found among present-day merino flocks in Australia and South Africa. W.

**Studies on Merino Wool Production: Fleece Tests on Stud Sheep.** V. Bosman. *Fmg. in S. Africa*, 1943, 18, 789-794. Practical applications, originating from the merino fleece testing service, undertaken at the Onderstepoort Sheep and Wool Research Laboratories, during the past ten years, are outlined. The data show what standards of wool production are prevalent among stud sheep, and these are discussed in relation to the characteristics that control production. The clean dry wool production of stud rams should range from 10 to 15 lb., and that of stud ewes from 6 to 10½ lb. The factors of length, fibre fineness and fleece density are discussed in relation to these standards of production. Fleece testing is a necessary basis for reliable progeny tests of stud rams, and a system of group testing might profitably be employed. W.

**Sheep Blowfly Investigations in the Winter Rainfall Area.** H. O. Mönning and P. A. Cilliers. *Fmg. in S. Africa*, 1943, 18, 799-801. Maggots collected from living sheep, and representing all seasons of the year, were, without exception, those of the green blowfly *Lucilia cuprina*. Sheep carcasses were unimportant as breeding places for *L. cuprina*. Traps with meat bait were of no use in the control of sheep blowflies. Since *L. cuprina* breeds almost exclusively on live sheep, the best control measures are the regular treatment of all struck sheep to kill the maggots, selective breeding to reduce the susceptibility of sheep, crutching, and regular treatment for internal parasites. W.

**Derris Suspension as Sheep-dipping Fluid.** L. Morrison and G. B. McLeod. *New Zealand J. Sci. Tech.*, 1941, 23 A, 244-254 (through *Brit. Chem. Abs.*, 1944, B III, 4). Control of *Melophagus ovinus* (sheep ked or "tick"), lice and fleas is obtained by dipping sheep in a suspension of ½ lb. derris powder (containing < 4 per cent. of rotenone) per 100 gal. water. W.

**Eradication of Sheep Ticks, *Melophagus ovinus*, by One Dipping in Dilute Derris-water or Cube-water Dips.** N. G. Cobbett and C. E. Smith. *J. Amer. Vet. Med. Assoc.*, 1943, 102, 6-10 (through *Brit. Chem. Abs.*, 1943, A III, 910). Single dipping of sheep with derris powder (5 per cent. rotenone) or cube powder, 6 oz. per gal. water of either preparation, effectively eradicated the common sheep tick; no toxic effects were seen. W.

**Itch Mite of Sheep: Bionomics, and Control with Lime-sulphur Dips.** N. P. H. Graham. *Australia: J. Council Sci. Ind. Res.*, 1943, 16, 206-214. Experiments were conducted on the transmission of the itch mite of sheep (*Psorergates ovis*, Womersley, 1941). Transmission took place readily from machine-shorn sheep to other shorn or unshorn sheep, transmission from woolly sheep being much slower. Under experimental conditions, sodium arsenite solution containing 0.2 per cent. arsenic trioxide and suspensions containing 0.005 per cent. of rotenone, though killing a large proportion of mites, were not 100 per cent. effective. Dilute solutions of lime-sulphur containing 0.4 per cent. or more weight/volume of polysulphide sulphur completely eliminated mites. For field

use a lime-sulphur dip containing 1 per cent. weight/volume polysulphide sulphur and 0.3 per cent. weight/volume of "Agral 3" (a wetting agent) was prepared. Groups of infested sheep were marked and dipped at selected periods during the general dipping of the flock, skin scrapings being taken at intervals for 8 months after dipping. Mites were not found except for a limited period in those skin sites in which complete wetting was difficult to achieve. The polysulphide-sulphur of the swim dip remained within effective limits during the progress of dipping. W.

**Fertility in Sheep.** R. B. Kelley. *Australia: Council Sci. Ind. Res., Bull.* No. 166, 1943. An experimental study of periodicity of oestrus and non-breeding seasons in Australia. W.

#### (C)—VEGETABLE

**Cotton Bolls: Shedding; Influence of Light Intensity.** A. A. Dunlap. *Science*, 1943, 98, 568-569. Laboratory, greenhouse and field experiments show that interruptions for two or three days in the intensity of solar radiation on the growing plant lead to considerable shedding of fruiting forms (squares and young bolls). This supports the opinion of Canney (B.C.I.R.A.; 1924) on the effects of cloudiness on boll shedding. C.

**Cotton Seed: Disinfection.** W. Ray. *Plant Diseases Repr.*, 1942, 26, 474-476 (through *Rev. Appl. Mycol.*, 1943, 22, 478). When seed of Stoneville 2B cotton, (1) fuzzy, (2) re-ginned, and (3) acid-delinted, was treated with new improved Ceresan at the rates of  $\frac{1}{2}$ , 1 and  $1\frac{1}{2}$  oz. per bushel and planted, the treatment, regardless of the rate of application and the kind of seed, gave stands statistically superior to those of the controls. No significant differences were found for the amount of ceresan applied when expressed in percentage of final stand. The acid-delinted (gravity-graded) seed was superior in point of stand to the other kinds. These results show that the amount of ceresan applied to fuzzy, re-ginned, and acid-delinted cotton seed can safely be reduced to less than  $1\frac{1}{2}$  oz. per bushel. C.

**Cotton Seed: Disinfection.** H. P. Smith and M. H. Byrom. *Bull. Tex. agric. Exp. Sta.* 621, 1942, 16 pp. (through *Rev. Appl. Mycol.*, 1943, 22, 478). Undelinted cotton seed treated with ceresan, lime and sulphur at Texas Agricultural College Station gave, respectively, 71, 55 and 59.6 per cent. average emergence, as against 59.8 per cent. for the control, the corresponding figures for Nacogdoches Substation being 83, 54, 58 and 59 per cent. The figures for delinted seed similarly treated were 85.4, 73.6, 79.3 and 80.5 per cent. in the former place and 89.4, 72.5, 82.8 and 80 per cent. for the latter. Thus, with both undelinted and delinted seed, ceresan treatment substantially increased stands as compared with lime or sulphur or no treatment. Lime appeared to reduce germination, whilst sulphur had little, if any, effect. C.

**Cotton Seedlings: Damping-off.** C. H. Arndt. *Phytopathology*, 1943, 33, 607-611 (*Rev. Appl. Mycol.*, 1943, 22, 478-479). *Pythium ultimum* is a common agent of the damping-off of cotton seedlings in sandy loam soil in South Carolina when planting is followed by cool, wet weather. In experiments in which Cleveland Big Boll seedlings from acid-delinted, sterilized seed were grown in soil inoculated with a raisin-oatmeal agar culture of the fungus at temperatures of 18°, 21°, 24°, 27° and 30° C., and a moisture content of 60 per cent., only slight infection occurred at 30°, but severe at lower temperatures, all the plants being killed at 21° and 18°. The results secured when the seedlings were grown for 6-12 days at 30° in infested soil and then transferred to 22° indicate that *P. ultimum* will cause heavy losses through damping-off only if conditions favouring infection develop before the host reaches a stage of maturity comparable to that attained in a growth period of six days at 30°. C.

**Cotton Seedling Diseases and Boll Rots: Distribution and Dissemination.** P. R. Miller and R. Weindling. *Plant Diseases Repr. Suppl.*, 141, 1943, 53-78 (through *Rev. Appl. Mycol.*, 1943, 22, 479). A summary is given of surveys of cotton diseases conducted from 1938 to 1941 in 14 American states. *Glomerella gossypii* was recovered from 81.2 per cent. of the diseased seedling samples and from 67.8 per cent. of the bolls. It was widely distributed throughout the south-eastern states, but in Texas and Oklahoma its occurrence was limited to the eastern portions. The failure to find this fungus in the western belt is attributed to unfavourable, dry conditions preventing its survival during the



period between the damping-off and the boll rot stages. A simple relationship between climate and relative abundance of *G. gossypii* could not be established, experimental data indicating that in addition to rainfall other factors are important, such as availability of dead plant tissue and of shade provided by close stands. The fungus survives the summer in Texas on the stems, leaves and bracts of cotton plants. Latent infections of stems, leaves and other organs of the cotton plant often occur in the eastern parts of the cotton belt, to be followed, when moisture conditions become favourable, by saprophytic development in rotting tissues, thus providing potential sources of inoculum for boll infection and seed infestation. In South Carolina, contamination was carried over from infected trash to seed cotton, in proportion to the spore load of the trash, and from severely contaminated seed samples to those ginned subsequently. The conclusions are drawn that contamination of seed in the gin accounts for much of the *Glomerella* damping-off of seedlings in the eastern part of the cotton belt, and that infected trash plays an important rôle in this process. In ginning tests with seed samples from South Carolina and Georgia (all containing *G. gossypii*) and from Oklahoma and Texas (all free from infection), it was found that after ginning the infected cotton, spores left on the ginning equipment caused sufficient contamination of the clean samples ginned subsequently to be detected by the spore load determination method. When seed contaminated by *G. gossypii* was planted in 20 different localities, spore load determinations made on seed after ginning showed that relatively high spore loads were present on seed from localities in the more humid belt, e.g. coastal areas, and low loads on those from the inland sections of the eastern cotton belt where lower humidity prevails; no spores were found on seed from the sub-humid and semi-arid belt of Texas and Oklahoma. C.

**Cotton Seedlings: Infection by Fungi.** T. J. Harrold. *Phytopathol.*, 1943, 33, 666-673 (through *Rev. Appl. Mycol.*, 1944, 23, 15). In inoculation experiments on College No. 1 cotton seedlings, *Glomerella gossypii* and *Fusarium moniliforme* [*Gibberella fujikuroi*] pursued similar courses in respect of penetration and mode of development in the host, both acting as intracellular parasites that eventually destroy the host cells. Features of infection by the two fungi include necrosis of the cortex and stele, enlargement of the hypocotyl above the site of invasion, and lateral flattening of the same region at the point of entry of the pathogens. There were, however, several differences between the effects induced by the two parasites. The hypocotyls attacked by *G. fujikuroi* attained a length of up to 5 in., equal to that of the controls, whilst those in the *G. gossypii* series reached only 1 in., the former fungus produced less external mycelium than the latter, and the seedlings infected by *G. fujikuroi* commonly developed a whorl of lateral roots at the area of ingress, which may account for the stronger tendency to survival in the hosts of this organism than in those harbouring the agent of anthracnose. C.

**Raw Cotton: Future Marketing.** A. B. Muir. *J. Textile Inst.*, 1944, 35, Pt-7. C.

#### (D)—ARTIFICIAL

**Wood Pulp: Composition and Properties.** R. E. Dörr. *Angew. Chemie*, 1940, 53, 292-299 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 37). The constituents (contents of  $\alpha$ -,  $\beta$ - and  $\gamma$ -cellulose, hemicellulose, lignin, resin, ash, and, after hydrolysis, glucose, mannose and xylose) and physical properties (viscosity, degree of polymerisation, swelling, copper number, etc.) of woods, wood pulps, and straw are diagrammatically represented and discussed with reference to their bearing on the quality of derived viscoses. C.

**Casein Fibres of High Resistance to Hot Water: Preparation.** G. A. Arbuzov and A. M. Katz. *J. Appl. Chem. Russ.*, 1942, 15, 354-361 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 372). The fibre is soaked in aqueous formaldehyde at pH 4-5 for 8-10 hours, washed, and then soaked in 0.9 per cent. chromic sulphate at 45° for 45 min. The strength of the resulting fibre is 70 per cent. that of wool, and it is highly resistant to the action of hot water. It may be dyed in the same way as wool. C.

**Rayon Factory Waste Water: Treatment.** See Section 8I.



**Rayon: Production; New Developments, 1943.** *Silk J. Rayon World*, 1944, 20, No. 236, 22-24. A broad review of recent researches and inventions in rayon production under the main headings (1) viscose, (2) nylon, (3) cellulose ether fibres, and (4) proteins. C.

**Straw Pulp: Bleaching.** See Section 4G.

#### PATENTS

**Yarn Liquid Treatment Apparatus.** T. Jackson and F. B. Hill. B.P.558,958 of 11/7/1942:28/1/1944. Apparatus for the treatment of yarns with liquids which is simple to thread up comprises a substantially closed treatment chamber provided with an injector serving both as an inlet for the materials and as means for producing an induced fluid current into the chamber, and with an outlet for the exit of the materials from the chamber. The injector comprises an inlet for the materials and one or more passages through which a fluid current can be forced and which will direct the current so that it sets up an induced fluid current through the inlet. The apparatus is particularly useful for the stretching of cellulose derivative yarns in wet steam. For this purpose the injector is provided with means for feeding water into the inlet for the materials. The injector thus serves both as a yarn inlet which can be threaded up automatically and also for the introduction, continuously with stretching, of a stream of water in contact with the yarn. The stream of water prevents steam from blowing back through the inlet and thereby avoids any tension opposing the travel of the yarn due to a counter-current of steam. It also ensures that the steam in contact with the yarn is wet. The outlet for the yarn is formed in a detachable plug which is screwed or otherwise fixed in a socket in a wall of the chamber. C.

**Filaments and Threads: Stretching.** T. Jackson and T. B. Frearson. B.P. 558,963 of 20/7/1942:28/1/1944. In a process for the stretching of threads in the presence of a softening medium, the stretched thread is taken up by means of a twisting and winding device adapted to collect and twist the thread as fast as it is fed, and the tension imparted to the thread by the mode of its collection is utilised to initiate the stretching. During the initial application of the softening medium, the applied tension brings about stretching to a degree which increases as the softness of the thread increases, and when the stretch has thus been brought nearly up to the degree desired, the threads may be placed under the positive control of stretching means such as rollers, which thereafter accurately determine the degree of stretch imparted and feed the threads to the twisting and winding device by which they are then collected. Individual chambers, one for each thread, may be provided, in which the softening medium is applied to the thread and in which stretching of the thread takes place. Ring-twisting devices are particularly suitable for use as the twisting and winding devices. The stretching process described is particularly applicable to threads consisting of continuous filaments of organic derivatives of cellulose. C.

**Rippled Rayon Thread: Production.** E. I. Du Pont de Nemours & Co. U.S.P.2,328,074. Cellulosic filaments of different deniers are spun under different tensions, that for the finest being at least twice that for the coarsest, then doubled and dried while still in the gel state, by supporting the thread in a loose condition free from tension. C.

**Vinyl Filaments: Spinning.** S. Buchsbaum & Co. U.S.P.2,328,125. Plasticized vinyl resin is melted and fed through an orifice to a supply container from which it is drawn off as a filament. C.

**Strong Viscose Rayon: Spinning.** American Enka Co. U.S.P.2,328,307. Viscose is spun into a bath containing at least 10 per cent. of ammonium sulphate, less than 3 per cent. of sulphuric acid, and sufficient of metallic salts to retard the regenerative action of the acid, and the filaments are then stretched during regeneration in a bath at 75-80° C. that contains only such acid and salts as are carried over from the first bath. The filaments have a dry strength of at least 3 grams per denier and extension at break of less than 10 per cent. C.

**Air-streamed Cotton Gin.** C. R. Berry, L. S. Gamble and R. Jones. U.S.P. 2,328,774. A closed circuit is provided for the travel of loose seed cotton in an air stream. Seed cotton is fed to the circuit and seed discharged from it through valves, and a rotary toothed member protruding into the circuit strips the lint

from the seed. Near this member there is a blower for maintaining the air stream. C.

**Centrifugal Spinning Pot Drive.** American Viscose Corporation. U.S.P. 2,329,499. The spinning pot is positively coupled to a drive member by a unit pivotally mounted between the ends of the hollow hub which is actuated by centrifugal force. C.

**Viscose Waste Water Sulphur: Recovery.** Vereinigte Glanzstoff-Fabriken, A.-G. Dutch P.51,815 (through *Chem. Zentr.*, 1942, 1, 2050 and *Water Pollution Res. Summ. Current Lit.*, 1943, 16, 29-30). In the recovery of sulphur in the viscose industry, the waste waters, which contain sulphides, are acidified and are diluted so that the liberated hydrogen sulphide remains in solution. The solution is treated with sulphur dioxide to convert the hydrogen sulphide to sulphur, which can then be separated. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Card Flats: Setting to Save Cotton in the Strips.** E. H. Helliwell. *Textile World*, 1943, 93, No. 11, 90-92. The writer discusses the feasibility of halving the loss of good cotton in flat strips, without reducing carding efficiency, by appropriate adjustments of speeds and settings. Observations made with tinted laps are recorded. By reducing the speed of the flats to about  $1\frac{1}{2}$  inches per minute (one flat per minute under the action of the flat comb), and setting the back plate at 29/1000 in., bottom, 22/1000 top, and the front plate at 22/1000 in. top and bottom, the strips obtained were much darker in colour and contained 52 per cent. of good fibre instead of about 65 per cent. The appearance of the web was not affected and the nep count was not altered. Further possibilities are mentioned and a list of suggested settings is attached to a diagram of the setting points. C.

**Card Laps and Sliver: Piecing-up.** F. Wooding. *Textile Weekly*, 1944, 33, 208-211. A practical account is given of the card grinder's work of piecing-up laps and the draw-frame tenter's work of "creeling under" fresh cans of sliver, and variable skill and attention are suggested as contributory factors to the complexity of the "drafting wave." C.

**Condenser Card: Maintenance.** E. Taylor. *Textile Manufacturer*, 1944, 70, 30. Practical hints are given on the grinding, setting and care of cards in a condenser waste mill. C.

**American Cotton: Carding; Effect of Grade on Waste.** J. M. Cook and A. Y. Willis. *Textile World*, 1943, 93, No. 12, 89. Five bales of cotton ranging from Good Middling to Low Middling in grade, but all about  $1\frac{1}{3}$  to  $1\frac{3}{4}$  in. in staple length were put through the same opening treatment and then divided into ten lots that were carded at cylinder speeds of 168 and 192 r.p.m. and doffer speeds of 8, 10, 12, 14 and 16 r.p.m. The slivers were spun to 20s, 30s and 40s warp yarns. A table gives the percentages of flat strips and other wastes for the G.M. and L.M. cottons. The yarns became progressively poorer in appearance and the card web became more neppy as the grade of cotton was lowered and these effects of grade were more pronounced than those due to increasing the carding speeds. The strengths of the yarns were not affected by changes in the carding speeds. C.

**Cotton: Carding; Research Programme.** M. E. Campbell. *Textile Research*, 1943, 13, No. 14, 14-18. The importance of the cotton card is discussed and a brief account is given of the facilities for research at the Textile School of North Carolina State College where an intensive study of cotton carding is being carried out by the U.S. Textile Research Institute. The programme comprises two parts (1) studies of the effects of individual variables, e.g. the effects of changes in speed of the entire machine, cylinder, licker-in, doffer, and flats, and the effects of varying front plate settings, weight of lap fed, and draft; (2) studies of various combinations of these variables and other factors affecting production. Four qualities of cotton are being used in the tests. Details are given of the method used for determining the effects of varying the licker-in speed. C.

## (B)—SPINNING AND DOUBLING

**Ring Cleaning Device.** R. Burgess (Brookline, Mass.). *Textile World*, 1943, 93, No. 11, 132. To clean rings on spinning or twisting frames the writer has had some bobbins converted into brushes with the tufts set in spirals of about two turns per bobbin, the bristles making the brushes slightly larger than the rings. Each spinner runs twelve of these on the spindles and moves them to fresh spindles as the cleaning progresses. C.

**Rings and Travellers: Developments.** D. Eadie. *Textile Weekly*, 1944, 33, 281-2; *Textile Manufacturer*, 1944, 70, 118. A brief review of modern trends in the styles and dimensions of rings and travellers, in Lancashire, the United States, and Germany. C.

**Spinning Mill: Reorganisation.** (1) A. C. C. Robertson. (2) A. Roberts. *Textile Weekly*, 1944, 33, 276-8, 322-5; *Textile Manufacturer*, 1944, 70, 98, 110. Reports are given of two addresses in which the speakers gave the operative's point of view on desirable improvements and safety measures in the various processes of cotton spinning and in the recruitment of labour. C.

**Systems of Worsted Processing: English and Continental Methods Compared.** A. Poncelet. *Wool Rec.*, 1944, 65, 92-94, 129, 132, 134, 136. The introduction of up-to-date machinery involves first of all consideration of the building and of the space available for the machinery. Individual electric drives should be introduced as far as possible. English and Continental methods are compared as regards (a) processing mohair, alpaca; lustre wools, etc., (b) combing, (c) hand-knitting yarns, (d) weaving, (e) drawing laps and waste, and (f) staple fibre. English and Continental methods are also compared as regards size and lay-out of combing, drawing and spinning sets. Hours of work and management in the two systems are discussed. W.

## PATENTS

**Combing Machine Guard.** Platt Brothers & Co. Ltd. and D. Pierrepont. B.P.558,948 of 18/4/1942:28/1/1944. The combing machine is provided with a combination of movable guard means adapted when in lower position to encase substantially all of the mechanism and when raised to an upper position to expose the mechanism, means for starting and stopping the machine, means effective to prevent the guard means from being raised or lowered unless the mechanism is in correct working position, means to prevent starting of the machine save when the guard means are in the lower position, lidded suction boxes at the back of the machine, and means interlocked with the starting and stopping mechanism for preventing the lids from being opened while the machine is in operation and for preventing the machine from being started while a lid is open. The guard preferably comprises a row of covers of which each serves to cover at least one delivery head of the machine, the covers at the ends of the row being each provided with an end plate, and intermediate covers being interchangeable. C.

**Combing Machine Guards.** Platt Brothers & Co. Ltd. and D. Pierrepont. B.P.558,978/9 of 18/4/1942:28/1/1944. (1) A combing machine is provided with a combination of a guard device, which may be in one piece or may consist of a row of cover members, adapted to cover the front of the combing machine, extending from the creel uprights to the front sliver table, thereby encasing moving parts, a setting-on rod, a spring-urged detent located in the path of an arm on the setting-on rod and preventing starting movement of the setting-on rod in the raised position of the guard, a detent-releasing member carried by the guard and engageable by the arm in the starting movement of the setting-on rod, and a brake released by starting movement of the setting-on rod, but automatically applied on reverse movement of the setting-on rod whereby to decelerate the machine quickly, so that the machine will be brought substantially to a standstill before the guard can be raised by the operative. (2) A guard is arranged to prevent the suction-box lids at the rear of the machine from being opened while the machine is in motion, and, if the suction-box lids are open, to prevent the machine from being set in motion until all the lids are restored to their closed position. The guard is arranged to co-operate with a brake released by starting movement of a setting-on rod, but automatically applied on reverse movement of the setting-on rod. Two embodiments of the invention are described. C.

**Carding Engine Cylinder Stripping Door Safeguarding Mechanism.** Platt Brothers & Co. Ltd., I. Leech and J. K. Clegg. B.P. 559,009 of 8/10/1942: 31/1/1944. In safeguarding mechanism for the cylinder stripping doors of carding engines there is provided a simplified connecting rod with provision for attaching and adjusting the same with respect to a movable part which operates a locking bolt and the stripping door locking lever. C.

**Fibrous Waste Working Machine Metal Collectors.** H. S. Greenwood. B.P. 559,122 of 1/8/1942: 4/2/1944. In apparatus for breaking-up, opening or working cotton or other fibrous waste or textile material there is combined with a lattice arrangement for lifting the material, two inclined conducting shutes, one delivering to the other and arranged at different angles, for inverting the fibrous material or changing its disposition and directing it over permanent U-shaped magnets mounted in the guide plates or walls of the shutes. The second shute delivers the fibrous material to a lattice or other conveyor feeding a breaker or other machine. C.

**Combing Machine Revolving Clearer.** Platt Brothers & Co. Ltd. and D. Pierpont. B.P. 559,125 of 9/9/1942: 4/2/1944. A revolving clearer of the type used for clearing the waste fibres from the leather-covered top detaching rollers of Nasmith and Heilmann combing machines comprises a clearer roller rotatably mounted in a pair of co-axially pivoted bearer arms and loaded frictionally-acting means, e.g., a dog, wedge, or the like, on at least one of the arms adapted to impose frictional resistance to rotary movement of the roller in one direction. The dog, wedge or the like is preferably spring-influenced and is engageable with a surface of revolution presented by a bowl or drum fast on one end of the axle of the clearer roller. The bearer arms are preferably each furnished with an extension to facilitate the lifting of the clearer away from the detaching roller and to minimise risk of injury to the hands of an operator. C.

**Draw-frame Roller Clearer.** Saco-Lowell Shops. U.S.P. 2,328,324. The claim is for adjustable supports for the roller clearing belt so that its over-all length can be adjusted as changes are made in the roller settings, whereby the belt is maintained taut. C.

**Spinning Frame Driving Tape Tensioning Pulley Guard.** Saco-Lowell Shops. U.S.P. 2,329,159. The pulley is carried by an arm and arbor and a guard is fixed to the arm, by means of a set screw, with a leg portion extending through a hole in the arm to a groove in the arbor. C.

**Roller Drafting Head.** Saco-Lowell Shops. U.S.P. 2,329,655. The lower rollers of a number of pairs of upper and lower drafting rollers are supported in spaced relationship and certain of the upper rollers are held by cap bars supported at points between the front and rear rollers. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Beam Winding Operatives: Payment.** John Middleton. *Cotton (U.S.)*, 1943, 107, No. 11, 87-89. The writer describes the introduction in a department for beaming heavy duck warps of a group bonus system which has led to good team work and increased production. Various obstacles that had to be overcome are noted and it is stressed that in such systems the operative must clearly understand how the bonus is calculated. C.

**Pirn Winding Room: Management.** A. C. Wayman. *Textile World*, 1943, 93, No. 11, 96-97; No. 12, 84-85. Practical hints are given on the management of a pirn winding department to secure the same tempo as the weaving room, and to reduce defects. Suggested work tickets and record cards are illustrated and a table shows various cloth defects against causes inherent in faulty pirning. C.

**Electronic Relay Beaming Machine Stop Motion.** A. P. Mansfield. *Textile World*, 1943, 93, No. 12, 74. The ordinary electromagnetic relay sometimes fails because the contact points of the drop wires and metal bar become fouled with dust and fly. This difficulty is overcome by using an electron tube relay, which will operate even when the resistance in the stop-motion contact circuit is as high as 500,000 ohms. Illustrations show a beaming machine with the

yarn passing through "drop switches," and an 8-valve relay. The machine is said to stop almost instantaneously if an end breaks. C.

**Nylon Yarn: Winding.** *Silk J. Rayon World*, 1944, 20, No. 237, 30-32. Practical hints are given on the winding of pineapple cones of nylon yarn, with particular attention to tension regulation, the detection of undue tension, and dressing the yarn with oil emulsion. C.

**Warping Machines: Maintenance.** *Textile World*, 1943, 93, No. 12, 86-87. Practical advice is given on the overhauling, cleaning and lubricating of warpers, and copies are reproduced of instruction cards for the maintenance, inspection and lubrication of the Barber-Colman machine. C.

#### (B)—SIZING

**Cotton Blanket for Tape Frames: Application.** *Textile World*, 1943, 93, No. 12, 122, 130. Evidence is given on the superiority of cotton blanket over wool for covering the squeeze rollers of a tape frame. The cloth used is woven from 1½s warp and weft, 62 ins. wide, napped on one face, and 15 yards of it are used on the finisher (2nd) squeeze roller. To improve the "cushion" when necessary, a few yards are unwound and soaked thoroughly from a hose-pipe. This is also done after a week-end stop, instead of removing all the blanket and leaving it in water. C.

**Cotton Warps: Sizing.** Textile Operating Executives of Georgia. *Textile World*, 1943, 93, No. 12, 72-73. The following particulars, provided by 16 mills, are tabulated: (1) type and fluidity of starch used, (2) time taken to bring size to the boil, (3) size cooking temperature, (4) cooking time, (5) temperature of storage kettle, (6) temperature in sow box, (7) yarn stretch, (8) stretch at which warp strength is affected, (9) regain of taped warp, (10) method of controlling regain, (11) method of testing regain, (12) frequency of check, (13) count of yarn, (14) number of ends, (15) tapping speed, yards per minute. The data are discussed and the common practices are indicated. Thus, most mills used corn starch, but of various fluidity grades. Cooking temperatures were mostly 210-212° F., but times varied from 45 minutes to 2 hours. Regains ranged from 6½ to 8½ per cent. and six mills have the "Moist-O-Graph" control. Speeds ranged from 20 to 70 yards per minute. Notes on the practice of applying flannel to the squeeze rollers and on waste control are also summarised. C.

**Soap: Application in Sizing, Dyeing and Finishing.** See Section 4I

#### (C)—WEAVING

**"Button-hole" Selvedges: Causes.** *Cotton (U.S.)*, 1943, 107, No. 11, 85-86. The writer discusses the causes of a defect that most frequently occurs between the selvedge and the body of the cloth and resembles a button-hole. Practical suggestions for avoiding the trouble are given. C.

**Rayon and Spun Rayon Warps: Weaving.** *Textile Weekly*, 1943, 32, 784-6; 1944, 33, 212-4, 241-2. Practical hints are given on the selection of loom accessories and on loom adjustments to guard against damage to rayon and spun rayon warps, including long-staple "Fibro," and nylon warps. C.

**Northrop Automatic Loom: Application.** H. Gaudin. *Textile Weekly*, 1944, 33, 290-6, 330-2. A report of a lecture and discussion on automatic weaving by Northrop looms, with special reference to the training of students and operatives, British schools being adversely criticised. C.

**"Regan" Warp Stop-motion.** Crompton & Knowles Ltd. *Silk J. Rayon World*, 1943, 20, No. 235, 29-30; 1944, 20, No. 236, 25-26. A detailed description is given of a new stop-motion, with special reference to the drop-wire mounting and action, and the knock-off mechanism. The fitting and adjustment of the motion are explained in detail. C.

**Military Webbing and Ribbons: Weaving on Narrow Fabric Looms.** *Silk J. World*, 1943, 20, No. 235, 26-28; 1944, 20, No. 236, 28-30. Detailed descriptions are given of the following looms of the Haywood type (by Platt Bros. & Co. Ltd) and their adjustment for weaving narrow fabrics: (1) A loom with positive shedding by eight tappetts; (2) a loom fitted with negative dobby (Richardson, Tuer & Co.) and boxwood shuttle. C.

**(D)—KNITTING**

**"Nu-Way" Seamed Toe for Hosiery.** Whitlock Knitting Mills. *Textile World*, 1943, 93, No. 11, 93. Illustrations are given of a method for closing the toe by seaming instead of looping. In knitting, a tube  $3\frac{1}{2}$  ins. long is formed beyond the extension toe, and this is closed by over-seaming, with 26-28 stitches per inch, so that the seam falls under the middle of the foot. The cost is reduced from about 12 cents per dozen for looping to 5 cents per dozen for seaming and production is increased by 20-25 per cent. C.

**Double-woven Warp-knit Fabrics: Knitting.** *Rayon Textile Monthly*, 1943, 24, 647-649. Practical hints are given on the production of double-woven fabrics (e.g. glove fabrics) on the double-tricot and Milanese tricot machines. The typical "Atlas" (diagonal stitch) structure is explained. C.

**(G)—FABRICS**

**Cotton Duck Water Bag.** W. L. Hicks. *Textile World*, 1943, 93, No. 11, 147. An illustration is given of a water bag developed for use by the American services in desert and tropical regions. It is made from a "high-count cotton duck," "treated with natural gums to simulate those found in flax." Appreciable permeation to the outside surface and consequent evaporation keep the water cool. C.

**Figured Rayon Fabrics: Weaving.** *Silk & Rayon*, 1944, 18, 33-34, 105. Practical hints are given on the Jacquard apparatus, the let-off motion (Briggs), weft winding, and suitable shuttles for weaving figured rayon fabrics. C.

**Nylon Blood and Plasma Filters: Construction.** Elizabeth Glaser. *Science*, 1943, 98, 570. The writer recommends nylon fabric for filtering blood and plasma, but finds that sewn seams tend to shed loose fibre. She makes her filters with fused seams, by using the stylus of an electric poker-work set. C.

**Terry Fabrics: Weaving.** O. Pomfret. *Textile Manufacturer*, 1943, 69, 470-3, 536-8. An illustrated account of the general and special requirements of terry weaving, loom setting and timing. C.

**U.S. Army Socks: Lower Grade of Wool Used.** U.S. Quartermaster Corps. *Amer. Dyes. Rep.*, 1943, 32, 490. U.S. specifications for army socks (wool, light and wool, cushion sole) have changed the grade of wool from "not lower in grade than 60s U.S. standard" to "not lower in grade than 56s, and not higher in grade than 60s U.S. standard." The object is to increase the resistance to shrinkage under laundering conditions in theatres of operations. In addition, the grade of wool for the worsted yarn in the terry sole of the socks, wool, cushion sole, has been dropped to "not lower in grade than 50s and not higher in grade than 56s U.S. standard." W.

**PATENTS**

**Loom Shuttle Guard.** H. Richmond. B.P.558,905 of 8/9/1942:26/1/1944. A shuttle guard comprises two or more brackets each having an end part adapted to lie on and be screwed to the front face of a sley cap, an intermediate part adapted to project forwardly from the face, and another end part projecting in an oblique direction from the intermediate part away from the sley cap, the brackets being connected together at the last-named end parts by a rail intended to lie in front of and about level with the bottom of the sley cap, there being arms swingably mounted in front of the rail or brackets and carrying one or more guard rails connected pivotally to the arms and movable upwards and downwards therewith. One or more of the brackets may have a bent lug to form a stop which limits the movement of the arms in one direction. The first-named rail may have a projection on which one of the arms can bind frictionally to hold the arms temporarily in the inoperative position. One end of the first-named rail may project beyond the remaining rail or rails and have connected to it one end of a tension spring which acts to hold the arms in the operative position. The second-named rail or one of the second-named rails may have a handle projecting forwardly to facilitate movement of the arms into the inoperative position. C.

**Automatic Pick and Pick Weft Mixing Loom.** W. W. Triggs (Crompton & Knowles Loom Works). B.P.558,966 of 23/7/1942:28/1/1944. A weft-replenishing pick and pick weft mixing loom for weaving a fabric of uniform colour and texture is provided with a combination of two weft mixing devices, the

first comprising means whereby a number of shuttles become active in given order and means whereby each of the shuttles is followed by another shuttle after being active for only one pick of the loom, and the other device comprising means for supporting groups of reserve bobbins and means for releasing reserve bobbins from the groups for successive replenishing operations of the loom in a predetermined order whereby a mixing in the selection of bobbins is effected with respect to their groups of origin, the second device having means to insert the bobbins so released into the shuttles one after another as the shuttles become depleted of weft. C.

**Automatic Pick and Pick Loom.** W. W. Triggs (Crompton & Knowles Loom Works). B.P.558,967 of 23/7/1942:28/1/1944. In a weft-replenishing pick and pick loom adapted to operate with a number of shuttles a group of which all carry ground weft of the same kind and at least one of which carries distinctive weft different from the ground weft, comprises a slay, a pair of shuttle boxes on one end of the slay operating in a four-pick sequence to place the top shuttle box in inactive position for the first two picks and in active position for the last two picks, means to replenish any shuttle when exhausted and in the top box during the first two picks with reserve weft of the kind carried by the exhausted shuttle, a gang of shuttle box cells on the other end of the slay certain cells of which are adapted to cooperate with the ground weft shuttles and at least one of which is a home box for the distinctive weft shuttle, means to shift the gang with respect to the slay to move said certain cells to cooperate with the plain weft shuttles in a given order during weaving of ground weft with the home box in inactive position, and means to interrupt the normal shifting of the gang to move the home box to active position on a pick immediately preceding the first pick of a four-pick sequence of movements of the pair of boxes. Fabrics with decorative stripes are produced. The loom may also be used for weaving plain pick and pick fabrics. C.

**Taper-ended Bobbin.** Clark Thread Co. B.P.559,115 of 30/6/1942:4/2/1944 (Conv. 10/2/1942). In a taper-ended spool or bobbin of thread, the mass of thread or the like comprises a number of layers each of several thicknesses of thread wound to a pre-determined radial thickness and axial length, each successive layer has substantially the same axial length and is axially offset, both at the base of the bobbin and at the end of the layer opposite the base to a pre-determined degree in relation to the preceding layer, and the end of each layer adjacent the tapered base has a surface substantially perpendicular to the axis of the arbor, which surface forms with the surface of the tapered base an annular recess into which extend some of the threads near the end of the next adjacent layer. The structure of the offset successive layers at the end of the bobbin opposite to its tapered base may present, when the article is viewed in a direction perpendicular to the axis of the arbor, the configuration of a series of "right angle steps, or a series of scallops concave or convex toward the axis. C.

**Circular Loom Sectional Reed.** Juan Balsach and Sedalana Soc. Anon. (Buenos Aires). U.S.P.2,327,987. The claim is for spring mounting devices to prevent the vibration of the various sections of the reed. C.

**Flexible Winding Spool.** Industrial Rayon Corporation. U.S.P.2,328,335. The radially compressible spool resembles deeply corrugated metal rolled into a hollow cylinder. C.

**Yarn Guide.** E. I. Du Pont de Nemours & Co. U.S.P.2,328,541. The claim is for a yarn guide formed by bending a wire back on itself into a bight and two divergent legs, the centre portion thus resembling the letter W. C.

**Rayon Yarn Dressing Agent.** Celanese Corporation of America. U.S.P. 2,328,600. Relatively coarse filament cellulose derivative yarn is dressed with a liquid compounded of a mineral oil, an inorganic electrolyte, a long-chain aliphatic alcohol and a sulphonated higher fatty acid and then with a liquid compounded of a trialkylolamine resinate, a lower alcohol and a hygroscopic agent. C.

**Electric Stop Motion for Loom.** Swift Manufacturing Co. U.S.P.2,328,981. An electric warp stop motion is extended by electric means to stop the loom when a pre-determined "cut" has been woven. C.



**Abrasive Cloth: Manufacture.** G. S. Radford. U.S.P.2,328,998. Some of the threads incorporated in a plain fabric are composed of plastic filaments spun by extrusion from a mass containing abrasive material. C.

**Winding Machine Yarn Tensioning and Oiling Device.** Universal Winding Co. U.S.P.2,329,027. The claim is for a combination of yarn tensioning and oiling devices and means for gradually increasing the contact of the yarn on the oiling member as the package grows. C.

**Individual Warp Tension Device.** George Holden (Philadelphia). U.S.P.2,329,374. The device comprises an axle journaled in the loom standards, an arm projecting from the axle, a box supported by the arm, idler rollers mounted in the box, a tension roller also mounted in the box above and between the idler rollers and coacting with them, brake drums carried by the tension roller, mechanism including brake bands operable by the warp to relieve the action of the brake bands on the brake drums, and means to hold a spool. C.

**Laundry-stabilized Fabric: Construction.** Godfrey Bloch (New York). U.S.P.2,329,452. The fabric consists in one direction of spun rayon yarns interspersed with spun vegetable fibre yarns, interwoven at right angles with yarns containing at least 50 per cent. of rayon staple. C.

**Knitting Machine Web Holders.** Tompkins Bros. Co. (Syracuse, N.Y.). U.S.P.2,329,617. Web holders are pivotally mounted one between each pair of adjacent needles and are arranged to hold down the web in one position as knitted or to swing over to a position in which the hold is released as the needles operate to form stitch loops, the yieldable means that impart the pivotal movement also serving to apply uniform tension to the yarn regardless of the lengths of the stitch loops drawn by the needles. C.

**Circular Knitting Machine.** Tompkins Bros. Co. U.S.P.2,329,618. Brake means are fitted for separately applying braking force to the needle cylinder or the take-up mechanism on interruption of the drive. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Wash Bowl Minding.** W. H. Robinson. *Text. Merc.*, 1944, 110, 100-1, 103. A review of accepted methods of running 3- or 4-bowl scouring sets to which attention must be given during scouring experiments. Adjustable parts and mechanical maintenance are discussed, the former being concerned with automatic hopper feeds, rake motions, squeeze rollers and water levels, and the latter with the opening willey, hopper feeds, wash-bowl pumps and squeeze rollers, and drying machines. W.

##### (D)—MILLING

**Mill Rigging.** G. L. Atkinson. *Text. Col.*, 1943, 65, 473-476. A survey of the basic causes of mill rigging. Attempts to reduce or eliminate rigging by altering the draft board of the machine, by bagging the cloth, or by fitting hard rubber or composition milling rollers, have not solved the problem. If a framework carrying two or more spouts is fitted between the back carrying roller and the main rollers of the scouring dolly, and if the pieces are taken out of the milling machine when rigging has started and run in this adapted dolly, the riggs are successfully removed and the milling completed. Contrasting materials which are badly mill rigged can best be treated by hand with card clothing to pull up the fibres forming the rigg, subsequent cropping restoring the normal appearance of the fabric. W.

**Scouring and Milling: Processing Routine.** (1) G. L. Atkinson. *Wool Rec.*, 1944, 54, 18-19. (2) D. R. H. Williams, *ibid.*, 19, 21, 138. (1) Comments on Williams' processing routine for scouring and milling all-worsted khaki 22½ oz. serge (*these Abs.*, 1944, A 12). A test made on four pieces of this serge, using an ordinary rope-type dolly with wood rollers, and an ordinary milling machine with variable mouthpiece and clutch drive, gave superior results to those of Williams in milling time per piece (52½ min. as against 1 hr.). The two pro-



cessings are contrasted, particularly in regard to the weighting of the top roller, the short space of time taken in washing-off the pieces, and bagging the pieces. Scouring and milling on one machine does not necessarily offer advantages. (2) Williams' reply. Milling times per piece vary, 2-2½ hr. being fairly common. The top rollers in the Williams-Peace machine are balanced, and can work at any weight. Bagging is an extra precaution in reaching the standard necessary for fine worsteds. The advantages of the combined scouring and milling machine are enumerated. A washing-off time of 40-45 min. is sufficient, provided that the pieces are really clean before milling; this is confirmed by the Wool Industries Research Association's analysis of the cleanliness of the pieces in question. W.

#### (F)—CARBONISING

**Olive-drab Overcoating: Sulphuric Acid Carbonising.** K. S. LaFleur. *Amer. Dyes. Rep.*, 1943, 32, 473-476, 485-489. Carbonising 32 oz. olive drab overcoating reduced the residual matter to 0.14-0.77 per cent.; 0.25 per cent. should yield a bath of approx. correct strength, which was obtained by using 3-25 per cent. sulphuric acid at 77° F., and a liquor-goods ratio of 80:1. Wetting agents in carbonising were tested on overcoating squares, canvas squares, cotton skeins, oats, and wood; if the pieces contain >60 per cent. moisture when delivered to the carboniser, no penetrant is necessary. The relation between specific gravity and acidity of carbonising baths is discussed in relation to control by the Baumé hydrometer. W.

#### (G)—BLEACHING

**Peroxide Bleach: Application.** D. Butterworth. *Textile World*, 1943, 93, No. 12, 78-79. A brief outline is given, with illustrations of the plant, of a process by which such fabrics as herringbone twill can be continuously processed in open width at a speed of about 125 yards per minute, and lighter fabrics even faster. The essential feature of the process is that caustic-scoured cotton fabrics impregnated with hydrogen peroxide are bleached in a few seconds when exposed to live steam. The steps involved are (1) impregnating with caustic soda, (2) mangling, (3) heating by direct steam, (4) passage through a J-box, (5) washing in two vertical washers, (6) saturating with hydrogen peroxide, (7) mangling, (8) heating by direct steam, (9) bleaching in a J-box, and (10) washing in two vertical washers. C.

**Rayon: Bleaching, Dyeing, Printing and Finishing; New Developments, 1943.** *Silk J. Rayon World*, 1944, 20, No. 236, 34-39. A broad review of recent researches and inventions in the newer man-made fibres and their processing. C.

**Straw Pulps: Bleaching.** S. I. Aronovsky, G. H. Nelson and E. C. Lathrop. *Paper Trade J.*, 1943, 117, TAPPI, 258-268. Wheat, oat, rice, barley and rye straws, flax shives and soybean stalks were analysed and cooked with sodium hydroxide to yield pulps of various lignin contents, and then bleached by the single-stage and three-stage processes. The lignin contents, permanganate numbers, and Roe chlorine numbers were determined for the various pulps, and the inter-relationships between these characteristics and bleach consumption at a brightness (Hunter reflectometer) of 70 per cent. were studied. The data obtained show, in general, that these agricultural residues fall into two groups, with the cereal straws in one group and the flax shives and soybean stalks in the other. Straight-line relationships were obtained between lignin and permanganate and Roe chlorine numbers, and between permanganate and Roe numbers. Direct relationships were also found between bleach consumption and lignin content, permanganate number, and Roe chlorine number. Rice straw pulp consumes less chlorine than the other pulps bleached to the same brightness, possibly due to the high silicious ash content of this pulp. Economy in chlorine results when three-stage instead of single-stage bleaching is used, but this is partly offset by the higher loss in pulp substance with the three-stage process. To avoid excessive degradation of  $\alpha$ -cellulose, single-stage bleaching may be used to obtain pulps with brightness up to 70 per cent., but three-stage bleaching should be used beyond that point. C.

**Oxidised Cotton Fibre: Stabilization.** R. E. Reeves. *Ind. Eng. Chem.*, 1943, 35, 1281-1283. Damage to cotton fibre on oxidation by periodic acid does

not become fully apparent as loss of tensile strength until the oxidised fibre has been exposed to alkalis. Tests with various reagents that might be expected to react with and stabilize dialdehyde groupings against alkali have shown that if oxidation of the fibre is followed by treatment with sodium chlorite solution at pH 4 or with ethereal diazomethane, the total loss of strength after subsequent exposure to alkali may be greatly decreased. These treatments also reduce the alkali solubility and increase the cuprammonium viscosity of the oxidised fibre. The beneficial action of these reagents is believed to be due to the stabilization of weakened positions within the cotton fibre and not to an actual reversal of degradation. The probability that the action of chlorite on the oxidised fibre comprises selective oxidation of aldehyde groups to carboxyl groups, and the properties of the carboxyl-containing fibres are briefly discussed. C.

#### (I)—DYEING

**Aralac Fibre: Properties and Processing.** F. A. Prisley. *Amer. Dyes. Rept.*, 1943, 32, 532-533. The production, processing, properties and uses of the casein fibre, Aralac, are briefly discussed and illustrated by an account of the operations involved in the production of a dyed and finished worsted fabric containing 40 per cent. Aralac and 60 per cent. wool. C.

**Cellulose Acetate Rayon Full-fashioned Hosiery: Processing.** J. A. Crumley. *Amer. Dyes. Rept.*, 1943, 32, 524-526, 538. The importance of pre-boarding acetate hosiery is pointed out and the operation is briefly described. Investigations of the effects of steam pressures varying from 0.5 to 10 lb., (190° to 235° F.) on the finished stockings are reported. Breaking strength, lustre and depth of shade decreased with increasing pressure and temperature of pre-boarding. A steam pressure of 2½ lb. (210° F.) gave the best results. A one-bath dyeing process with the bath at a temperature of 170° F. is recommended, a suitable procedure being outlined. Finishing operations are briefly discussed. Precautions necessary for avoiding wrinkles and pressure marks are described. C.

**Cotton Waste: Dyeing.** A. Ellis. *Textile Weekly*, 1944, 33, 104-7, 256-8. A practical account of the cutting and dyeing of cotton waste. C.

**Dyes, Pigments, Textile Chemicals and Equipment: New Developments.** *Amer. Dyes. Rept.*, 1943, 32, 493-498, 539-544. Alphabetical lists of dyes and pigments and textile chemicals, placed on the market or further developed since November, 1942, are presented, giving indications of the manufacturers, nature, properties and uses of the products. New equipment which is briefly described includes an air-operated automatic control instrument, a constant cloth speed tuber, the "Coronation" Railway sewing machine, cushion surface wood rolls, a floor type de-tacking machine, a heavy duty padder-mangle, a compensating gate, a knit goods splitting, opening, extracting and folding range, plastic covered rolls, a sample dryer, and a squeeze roll extractor. C.

**Fluorescent Dyes: Use in Coatings and Plastics.** H. E. Millson and C. C. Candee. *Modern Plastics*, 1943, 21, No. 4, 126-128, 160. The use of fluorescent dyes in plastics, lacquers and other coatings is discussed and a table is given showing the solubility of various fluorescent dyes in various technical grade solvents and plasticizers. Test formulations for fluorescent enamels are given. The effects of dye concentration, addition of non-fluorescent dyes, the nature of the resin or other vehicle, and the properties, particularly colour, of the base to which coatings are applied, on the fluorescence of fluorescent coatings are discussed. It is pointed out that fluorescent dyes should not be used in coatings which are to be exposed to ultra-violet, day, or incandescent light for extended periods of time. Their usefulness is greatest in applications where extreme brilliance is required without maximum fastness. C.

**Rayon Dyes and Dyeing: Recent Developments.** C. C. Wilcock. *Textile Manufacturer*, 1944, 70, 35-39. A report of a lecture covering the following topics: (1) Suitable dyes for the package dyeing of rayon yarn, (2) "salt control," (3) experience with sulphur, vat and solubilized vat dyes, (4) dyeing of rayon staple and the use of "Fibrofix," (5) spun-dyed fibres, (6) dyeing of

cellulose acetate rayon from alcoholic solutions, (7) dyeing of nylon materials, (8) dyeing of alginate rayons, and (9) dyeing of Vinyon. C.

**Yarn Cheeses: Dyeing.** T. E. Clarke. *Amer. Dyes. Rept.*, 1943, 32, 551-553. A practical account is given of the pack system of yarn dyeing with sulphur, direct and vat colours. C.

**Loose Cotton: Effect of Dyeing on Properties.** See Section 5A.

**Light Fastness Standards: Production.** See Section 5C.

**Cellulosic Fibres: Dyeing with Direct Dyes.** J. Boulton. *J. Soc. Dyers & Col.*, 1944, 60, 5-16. In a study of the importance of dyeing rate in the dyeing of cellulosic fibres with direct dyes it is pointed out that the rate at which dye is taken up by the fibre depends on (1) the extent to which dye is more or less instantaneously absorbed by the immediately available surface, and (2) the rate of diffusion of dye molecules to the interior of the fibre. The extent to which dyes "strike" on to the outer layer of fibres and their individual rates of diffusion (or levelling) after the "strike" are not necessarily related. The effects of temperature and salt on these rates are discussed and the practical control of dyeing rate is considered. A time-salt test designed to show, for each dye, the exhaustion rate, or "strike," and the influence of salt additions on that rate, and a simple levelling test are described in detail, typical results being given and deductions from them discussed. The selection of dyes for use in mixtures is briefly considered. The determination of time of half-dyeing, a characteristic property of direct dyes, is described. It is pointed out that time of half-dyeing, or relative diffusion rate, of which it is a function, is a good general guide to levelling properties. A few exceptions are discussed. A revised list of dyes classified according to times of half-dyeing is given. C.

**Diazo-Coupling Reaction: Mechanism.** H. H. Hodgson and E. Marsden. *J. Soc. Dyers & Col.*, 1944, 60, 16-19. Recent studies of the decomposition of diazo compounds in neutral solution, the coupling of N-nitrosoacetoarylamides, the action of nitrosylsulphuric acid on  $\alpha$ -naphthylamine and on  $\alpha$ -acetnaphthalide, the coupling of potassium benzenediazosulphite, the coupling of diazo-oxides, and the formation of diaryls are discussed and suggested coupling reaction mechanisms are critically examined. It is shown that the observations can be most reasonably interpreted by means of the polarisation theory developed in a previous paper. C.

**Pigments: Application to Textiles.** E. Sewell. *Rayon Textile Monthly*, 1943, 24, 607-8, 651-2; *Silk & Rayon*, 1944, 18, 103-105. A brief review of the mineral khaki and lead chromate styles of dyeing and the fixation of pigments on fabrics by means of carriers and binders. C.

**Soap: Application in Sizing, Dyeing and Finishing.** Georgia Leffingwell. *Rayon Textile Monthly*, 1943, 24, 653-654. A summary is given of recent references to the use of soap in sizing, finishing with resins, delustering of acetate rayon, protection of dyed acetate fabrics against fading in burnt gas fumes, and in dyeing. C.

**Dyes for Wool Hosiery Yarns and Fabrics, with some Notes on the Effect of Chlorination.** H. Crook. *J. Soc. Dyers & Col.*, 1944, 60, 33-36. In the afterchrome process, full development of chrome blacks may be obtained with 0.5 per cent. dichromate; in the chromate process, full development with maximum fastness may be obtained with 2.0 per cent. chromate mordant. The use of the chrome mordant process wastes dichromate and is only admissible for dyeing essential materials. Black shades similar in tone to those produced from logwood can be obtained by using a combination of Solochrome Black W DFA and Coomassie Green T applied by the afterchrome method. Development with copper produces shades which are fast to light, but not to wet treatments. The growing importance of the chromate process is emphasized. The applications of Carbolan dyes are described, and precautions suggested in the use of Sulphonycyanine dyes and of Coomassie Navy Blue 2RNS. It is not necessarily true that all non-shrink finishes increase the dye affinity of the wool; the possibility is discussed that the reverse may be the case with the Negafel process. Treatment of damaged wool for 3 hr. in a bath of 2 vol. hydrogen

peroxide (buffered to pH 9.5-10 with about 3 lb. trisodium phosphate per 100 gal., at 40° C.) gives material which is far more level dyeing with acid milling dyes and chrome dyes than the untreated material. Conditions more suitable for intermittent processing can be obtained by reducing the concentration of peroxide and treating at a higher temperature for shorter times. Chrome dyes which usually possess little or no chromate-dyeing properties under normal conditions will dye non-shrink wool quite well by the chromate process. Novel effects can be produced on mixtures of normal and non-shrink wool, and this tone-in-tone effect can also be produced on entirely non-shrink fabrics if some of the yarn is treated with hydrogen peroxide after chlorination. Treatment with hydrogen peroxide also makes it possible to improve very considerably the level dyeing properties of tippy wool, and mixtures of Cape and Australian tops, and of Cheviot and East Indian wool, can be dyed evenly if previously treated with hydrogen peroxide. Level dyeing acid dyes have their fastness to wet processes reduced still further when dyed on non-shrink wool. W.

**Army Olive Drab Shade Dyed by the Monochrome Method: Fastness to Weathering.** N. G. Koehler. *Amer. Dyes. Rep.*, 1943, 32, P481-2, 484. Weathering tests were made on flannel dyed with all possible combinations of certain colours specially recommended for dyeing olive drab on woollen and worsted materials by the monochrome or chromate method. A combination of Acid Alizarine Flavine RA, Acid Anthracene Brown LE and Monochrome Black Blue GA produced a shade which withstood weathering better than any other combination tested and was also much faster than the present standard. A sufficient length of time for complete coupling of chrome was more important in obtaining fastness than fluctuations in the amount of chrome used. The fastness was also somewhat improved by the addition of chrome after boiling for a short time. W.

**Number of Sulphonic Acid Groups in Dye: Effect on Colour Fastness of Wool and on Dye Absorption.** A. M. Serebryakov. *Informatsionnyi Byull. Glavamitkrasi*, 1940, No. 6-7, 3-7 (through *Khim. Referat Zhur.*, 1941, 4, No. 4, 118-119 and *Chem. Abs.*, 1943, 37, 5246). A number of orange, red and blue monoazo and anthraquinone acid dyes were studied. Increasing the number of sulphonic acid groups in the dye increases the washing fastness, but not the rubbing and light fastness. The smaller the number of sulphonic acid groups in the dye the greater the percentage of dye absorption by the fibre; this is attributed to the greater number of molecules of the dye required to bind the basic groups of the wool. W.

#### (K)—FINISHING

**Cellulosic Plastics: Characteristics and Uses.** R. H. Ball. *Modern Plastics*, 1943, 21, No. 4, 99-101. A general account is given of the characteristics of cellulose derivative plastics and the advantages and limitations of their use as moulding materials and for the production of sheets, films, foils, rods and tubes. C.

**Textile-Plastic Combinations: Adhesion.** C. W. Patton. *Amer. Dyes. Rept.*, 1943, 32, 513-523. For adhesion tests a piece of plastic compound 2 in. × 6 in. × 0.008 in. was placed against the crease on the inside of a 3 in. × 14 in. strip of fabric folded to 3 in. × 7 in. and subjected to 75 lb. per sq. in. pressure for 30 sec. at 225, 275 and 325° F. The strength of the bond was then determined by pulling the laminated pieces apart on a Scott testing machine. Tests were made on cotton, viscose and acetate rayon, wool and mohair fabrics in satin, twill, poplin, corduroy and flannel weaves, in finished and unfinished states. The plastics tested included thermoplastic and thermosetting vinyl butyral resin compounds, cellulose acetate collar interliner material, and thermoplastic vinyl chloride-acetate resin compounds. The results are presented in a series of tables and charts, and photographs of the fabrics are given. Differences between the different types of plastics and fabrics are briefly discussed, and the effects of differences in fabric structure and of various finishing treatments are noted. It is pointed out that arrangement of fabrics in increasing order of adhesion gives the same order as that of increasing surface roughness. It is concluded that adhesion of the plastics to the fabrics under the

conditions described is influenced largely by mechanical anchorage or dovetailing of the plastic in the surface irregularities of the fabrics. In general, the plastics having higher softening ranges required higher combining temperatures to develop maximum adhesion. The suitably high temperature causes the plastic to soften sufficiently to flow into and around the minute surface irregularities and extended fibres of the base fabric. In some cases where still higher lamination temperatures were employed, the plastic softened excessively and, under the pressure employed, was dissipated in the fabric, leaving insufficient material between the fabric surfaces to form a strong bond. Preliminary tests with plastic strips between two different fabrics indicated that the bond strength obtained approximates to the lower figure obtained when each of the fabrics involved is laminated to itself and tested for adhesion. Results of some exploratory work on the use of water emulsions of organic solvent solutions of the plastics are briefly discussed. C.

**"Utility" Printed Linings: Finishing.** *Textile Manufacturer*, 1944, 70, 32-34. Recipes and other working details are given for dyeing and finishing utility cotton linings No. 3990-3998 and rayon/cotton Italians No. 4990 and 4995. C.

**Textile Fibre-Rubber Combinations: Development.** C. M. Blow and W. Knight. *J. Textile Inst.*, 1944, 35, P7-18. C.

#### (L)—PROOFING

**American Services Proofed Vat-dyed Cotton Duck: Processing.** *Textile World*, 1943, 93, No. 11, 100-101. Abstracts are given of specifications J.Q.D. 226B and 242 governing vat-dyed and proofed "Numbered Duck Type II," and details are given of suitable dyeing, proofing and finishing procedures to meet the requirements. For water-repellent finishes, wax emulsions are recommended, with the addition of copper soaps, Na pentachlorophenate or phenylmercuric acetate or oleate for mildew proofing. For a water-, fire- and mildew-resistant finish the retardants are applied in solution with a film-forming resin. C.

**2:3-Dichloro-1:4-naphthoquinone: Use for Mildew-proofing and Seed Treatment.** W. P. ter Horst and E. L. Felix. *Ind. Eng. Chem.*, 1943, 35, 1255-1259. 2:3-Dichloro-1:4-naphthoquinone may be used for seed treatment or as a foliage spray to control plant diseases due to fungi. Successful results in the treatment of peas, beans and cottonseed are reported. Laboratory and soil burial tests have shown the compound to be a highly effective mildew-proofing agent for cotton fabrics against such moulds as *Chaetomium*, *Metarrhizium*, *Stachybotrys*, *Aspergillus*, and *Penicillium*. It does not affect the strength of the fabric and resists weathering. Methods of application are outlined and the results of tests on cotton fire hose, duck and sheeting are discussed. C.

**New Chemical Methods Against Warehouse Insects.** N. D. Pelikh and Others. *Trudy Voenno-Khoz. Akad. RKKA im. Molotova*, 1940, No. 3, 89-99 (through *Khim. Referat. Zhur.*, 1941, 4, No. 4, 89 and *Chem. Abs.*, 1943, 37, 5164). Laboratory and warehouse experiments indicate that ethyl formate is a good insecticide; the preparation is simple and the cost of the raw material low. The concentration required for the destruction of all kinds of warehouse insects is up to 0.25 g./l. W.

#### PATENTS

**Plastic Materials from Keratin-containing Materials.** Pilkington Bros. Ltd. and C. B. Joseph. B.P.556,721 of 19/10/1943. Finely-divided keratin-containing material, e.g. hair, feathers, bristles or wool, is degraded under controlled conditions to give a moulding powder which may be pressed or extruded, or dissolved in alkali and spun. The raw material is treated with a solution of sodium sulphide containing 9H<sub>2</sub>O, buffered to approx. pH 12.5 with e.g. amino acetic acid, until dissolved. A liquor adjusted to approx. 5 per cent. keratin product is recommended, which is then filtered and precipitated in fine form by spraying in  $\gg$  N/1 hydrochloric acid. The precipitate is then washed with neutral water and dried. The product may be hardened with e.g. formaldehyde during or after precipitation, giving improved water resistance. W.

**Shock-absorbing Material.** Lister & Co. Ltd. and W. Garner. B.P.557,103 of 4/11/1943. Shock-absorbing material is made from mineral, protein, cellu-

losic or synthetic fibres, especially those which are inherently resilient and which have an average diameter of less than 100 micromillimetres. The material consists of two or more superposed units, each unit comprising two textile fabrics into which are woven resiliently flexible textile elements which provide "legs" between the fabrics. The "legs" hold the fabrics apart by at least 1/12 in., and restore them to this spacing on the release of external compression. W.

**Papermaking Felts: Tanning to Increase Resistance to Degradation.** Institute of Paper Chemistry. B.P.557,693 of 1/12/1943. Wool felts are treated in a bath prepared by dissolving a chromium or aluminium salt in an aqueous alkaline hydroxide solution, separating the resulting hydrous oxide gel from the reaction solution, washing the gel obtained with water, redispersing the washed gel in water, and adding a small amount of a peptizing agent to the dispersed hydrous oxide. Examples are given using centrifugal and decantation methods for preparing the gel. A felt-liquor ratio of 1:6 and 20 min. treatment at 90° F. give the desired resistance to degradation, and, in the examples quoted, the impregnating liquor contains 1.4 per cent. chromium and 0.8 per cent. aluminium. W.

**Cellulose Ester and Ether Dyeings: Treatment to Improve Fastness to Gas Fumes.** B. Collie, C. H. Giles, D. G. Wilkinson and Imperial Chemical Industries Ltd. B.P.558,784 of 18/7/1942:20/1/1944. A process of treating materials consisting of or containing cellulose esters or ethers in order to enhance the fastness of colourations thereon to fumes from burning coal gas comprises applying to the materials before, during or after their colouration, an N-substituted diamine of the general formula  $RR'N(CH_2)_nNRR'$ , wherein R represents hydrogen, methyl, ethyl or  $\beta$ -hydroxyethyl, R' represents phenyl which may carry simple substituents such as alkoxy, alkyl or halogen, and  $n$  stands for 2-6. C.

**Nitrogenous Fibres: Dyeing.** Courtaulds Ltd. and J. H. Macgregor. B.P. 558,891 of 8/6/1942:26/1/1944. A process of dyeing nitrogenous textile fibres, such as wool, silk, casein and nylon, comprises pretreating the fibres with an aqueous solution of an amino compound in the presence of a small quantity of a free acid, and then dyeing with a direct cotton dye from a neutral bath. Specified amino compounds are cyanamide, dicyandiamide, melamine, dicyandiamidine, guanidine, biguanide, alkyl, hydroxyalkyl and aryl substituted dicyandiamidines, guanidines and biguanides and the salts of dicyandiamidine, guanidine, biguanide, alkyl, hydroxyalkyl and aryl substituted dicyandiamidines, guanidines and biguanides. The process is particularly valuable in the dyeing of union fabrics, e.g. those containing cellulosic fibres and animal fibres, particularly wool, since such union fabrics can be dyed in fast solid shades with direct cotton dyes in neutral baths. C.

**Guanidine Salts: Application in Rayon Finishing.** Courtaulds Ltd. and J. H. Macgregor. B.P.558,892 of 8/6/1942:26/1/1944. Cellulosic textile fibres, either as such or in the form of fabric, are treated with an aqueous solution containing a guanidine salt of a monoalkyl ester of an aliphatic dibasic acid so as to improve or modify the handle and other properties. Guanidine salts impart to the material a soft silky handle, particularly when long-chain alkyl esters are employed, e.g. guanidine octyl succinate. When employed in conjunction with formaldehyde, the guanidine salts of monoalkyl esters of aliphatic dibasic acids impart wool-like dyeing properties, as well as giving the fibre a soft and silky handle. This property of giving a soft and silky handle is also shown when a small proportion of a guanidine salt of a long-chain alkyl ester of an aliphatic dibasic acid is added to a solution containing urea and formaldehyde either as such or in the form of a water-soluble compound, and cellulosic textile fibre is treated with the solution and afterwards heated to convert the urea-formaldehyde into the insoluble compound. C.

**Polymeric Amide Bristles: Coating.** Imperial Chemical Industries Ltd. B.P.558,896 of 22/7/1942:26/1/1944 (Conv. 22/7/1941). Bristles of a synthetic polymeric amide are coated with a straight-chain alcohol containing an even number of C atoms from 12 to 18 inclusive, the coating being achieved

conveniently and preferably by bringing the bristles into contact with the substance contained in a liquid vehicle and thereafter evaporating the liquid from the surfaces of the filaments. This treatment makes possible the formation, by ordinary bristling technique and equipment, of full, straight, compact and neat tufts from the polymeric amide, which is difficult without the dressing treatment.

C.

**Coated Rayon Fabrics: Production.** British Celanese Ltd. B.P.553,899 of 22/7/1942:26/1/1944 (Conv. 9/8/1941). Coatings having a basis of an ester or ether of cellulose are formed on fabric composed of continuous filament yarns of regenerated cellulose containing plasticisers for the derivative of cellulose. The coating composition may be satisfactorily applied with relatively few individual coats and even after hard service the coated fabric remains free from blisters, and the danger of peeling and cracking is much reduced. Preferably the fabric is composed of regenerated cellulose yarns of high tenacity obtained by the saponification of stretched yarns of an organic ester of cellulose. Aircraft components may be made by stretching such a fabric over a suitable structure and coating the fabric in position with a coating composition having a basis of an ester or ether of cellulose, so as to tauten the fabric and render it resistant to moisture.

C.

**Coal and Tar Oil Waterproofing and Binding Dispersion: Production.** South Metropolitan Gas Co., H. Stanier and G. H. Fuidge. B.P.559,003 of 7/9/1942:31/1/1944. A waterproofing and binding material having a low susceptibility to changes in temperature of the order of that of blown bitumen is made by dispersing a coal having a high content of volatile matter and poor coking properties in a coal tar blend which contains about 40-55 per cent. of medium soft pitch having a softening point of 80° C. measured by the ring and ball method and about 60-45 per cent. of coal tar oil of b.p. above 300° C., the proportion of the coal being 15-25 per cent. of the weight of the final dispersion, and the dispersion being conducted at a temperature of at least 320° C. The products are specially suitable for the manufacture of roofing felt and paving materials.

C.

**Surgical Gauze: Production.** American Cyanamid Co. B.P.559,027 of 16/9/1942:1/2/1944 (Conv. 10/9/1941). Gauze for hospital use is impregnated with an aqueous emulsion containing 2-sulphanilamidopyrimidine and petroleum jelly or lanolin, and heated to sterilize the gauze and to disperse the emulsion uniformly throughout it. Preferably the gauze is first moistened with a dilute solution of a wetting agent or a wetting agent may be incorporated in the aqueous emulsion, suitable wetting agents being triethanolamine stearate or a mixture of triethanolamine and stearic acid.

C.

**Fabric Winding Apparatus.** British Celanese Ltd. B.P.559,066 of 10/7/1942:2/2/1944 (Conv. 12/7/1941). Apparatus for winding fabrics on a take-up roll or shell comprises a driven guide roll adapted to rotate about an axis at an angle to the central axis of the roll whereby fabric passing over the guide roll on its way to the take-up roll is given a side to side movement. According to the preferred form of the invention, a number of driven guide rolls are employed, at least one of which (A) is adapted to rotate about an axis at an angle to the central axis of the roll, and the driven guide rolls are driven at a peripheral speed lower than the speed at which the fabric is taken up by the take-up roll and preferably so that the guide roll (A) rotates at lowest speed. With this arrangement the position of the selvage is staggered as the fabric is wound so that piling up of the selvages resulting in turned and stretched selvages and creasing of the fabric is avoided.

C.

**Glass Fibres and Fabrics: Alumina Mordant Dyeing.** Elizabeth C. Maxwell, Ursula C. Maxwell and G. Barker. B.P.559,068 of 29/6/1942:2/2/1944. Vitreous fibres, e.g. of glass wool, or fabrics produced from them are coloured by providing them with a coating layer or film consisting of an aluminium colour lake. The fibres or fabrics may be impregnated with an aqueous solution of aluminium formate or acetate, dried under such conditions that the aluminium salt is converted into alumina, and treated with an aqueous solution of a dye. Alternatively, the fibres or fabrics may be impregnated with a mixture of an aluminium formate or acetate solution and a dye liquor, and dried.

C.

**Thermoplastic Resin Compound Fabrics: Production.** H. Meyer and Hart Productions Ltd. B.P.559,075 of 9/4/1942:3/2/1944. In a process for the



manufacture of a compound fabric, a fabric or paper is coated or impregnated with an irreversible water-insoluble but water-absorbent inorganic gel, preferably colloidal silicic acid, then treated with a solution or dispersion of a thermoplastic synthetic resin or a chlorinated natural or synthetic rubber and caused to adhere to one or two layers of fabric by the application of heat and pressure, the thermoplastic synthetic resin or chlorinated natural or synthetic rubber having a softening point above  $100^{\circ}\text{C}.$ , but below the temperature at which any of the fabrics employed in the manufacture of the compound fabric is damaged by heat. A compound fabric with an extremely strong bond between the inner lining and the outer layers is formed. C.

**Textiles: Mothproofing.** A. H. Goddin and N. E. Searle (to Canadian Industries Ltd.). Canadian P.412,891 of 1/6/1943 (through *Chem. Abs.*, 1943, 37, 5522). Trichlorobenzyl phenyl ether, trichlorobenzyl *o*-tolyl ether, trichlorobenzyl 2-acetylphenyl ether or trichlorobenzyl 4-*tert*-amylphenyl ether dissolved in acetone or alcohol is used as a mothproofing agent. W.

**Mothproofing Wool, Feathers or Furs.** H. Martin and Others (to J. R. Geigy A.-G.). U.S.P.2,312,923 of 2/3/1943 (through *Chem. Abs.*, 1943, 37, 5258). Quaternary cyclic monoamidines of the benzene series are used, preferably in aqueous solution. W.

**Felt or Straw Hats: Waterproofing.** C. F. Fabian and J. B. Lee (to Lee Bros. Hats, Inc.). U.S.P.2,314,135 of 16/3/1943 (through *Chem. Abs.*, 1943, 37, 5258). A composition is used containing a gel formed from a hydrocarbon vehicle, e.g. naphtha, and an aluminium salt of a fatty acid of high molecular weight derived from fats and oils, e.g. aluminium stearate, the gel being dispersed by an associated organic peptizing agent, e.g. acetone, containing the bivalent carbonyl radical  $=\text{CO}$  and containing no hydroxyl group. cf. U.S.P. 2,297,183 (*Chem. Abs.*, 1943, 37, 1613). W.

**Urea-Formaldehyde Resin Solutions: Production.** American Cyanamid Co. U.S.P.2,327,984. Alcoholic solutions of urea-formaldehyde resins, of low viscosity, are prepared by the acidic condensation of the reagents in the presence of a primary  $\text{C}_1\text{-C}_3$  alcohol and a monohydric alcohol having at least 8 C atoms. The mixture is kept hot so that water distils off with the lower alcohol, which is constantly replenished until no more water passes off, and then a second portion of the higher alcohol is added and distillation is continued until the lower alcohol is expelled. C.

**Cut Fabric with Sealed Edges.** Celanese Corporation of America. U.S.P. 2,328,063. To seal the cut edges of non-thermoplastic fabric the material is piled up with inter-layers of thin thermoplastic foil and cut with a hot tool. The foil fuses and seals the cut edges and the excess, beyond the cut, is then stripped off. C.

**Zirconium Oxychloride Emulsion: Application in Water-repellent Finishes.** General Aniline and Film Corporation. U.S.P.2,328,431. Textiles are rendered water-repellent by impregnation with an emulsion of paraffin, wax, a small quantity of fatty acid, zirconium oxychloride and a condensation product of oleyl alcohol and several molecular proportions of ethylene oxide. The material is washed to remove hydrophilic substances and dried at a high temperature. C.

**Bitumen Emulsion: Preparation.** Hercules Powder Co. U.S.P.2,328,481. Up to 3 per cent. of a sulphonation product of a pine resin, insoluble in petroleum, is used as agent for the emulsification of bitumen in water. C.

**Phosphatic Azo Dyes.** Eastman Kodak Co. U.S.P.2,328,570. The claim is for dyes of the formula  $\text{A}\cdot\text{N}\cdot\text{N}\cdot\text{B}\cdot\text{X}\cdot\text{Y}$ , where  $\text{A}\cdot\text{N}\cdot\text{N}-$  is the residue of a diazotised amine or aminoazobenzene, B is the residue of a benzene or naphthalene coupling agent, X is alkylene, cyclohexyl or phenyl attached to an N-atom in B, and Y is a phosphoric or thiophosphoric ester group. C.

**Pigmented Nitrocellulose Coating Composition: Filtering.** E. I. Du Pont de Nemours & Co. U.S.P.2,328,625. About 0.1-0.5 per cent. of a diatomaceous earth is used as an aid in filtering (under pressure) a pigmented nitrocellulose coating composition to remove grit and gel. C.

**Cellulose Acetate Materials: Dyeing.** R. Schnegg (Germany; vested in U.S. Alien Property Custodian). U.S.P.2,328,682. Articles of cellulose acetate with an acetic acid content of at least 50 per cent. are improved for dyeing by



treatment with acetic acid of at least 40 per cent., as a swelling agent, followed by soluble alkali or alkaline earth salts, as fixing agents of the swollen condition. They are then dried and dyed. C.

**Amine-Aldehyde-Amide Condensate: Application in Acid Dyeing.** Röhm & Haas Co. U.S.P.2,328,900. Before dyeing with an acid dye, organic fibrous material is treated with a condensation product of a non-aromatic amine having at least one free H attached to the N atom, an aldehyde, and a soluble polymeric amide. This product forms insoluble compounds with acid dyes. C.

**Vinyl Polymers: Dyeing.** American Viscose Corporation. U.S.P.2,328,903. Articles formed of vinyl polymers are dyed with suspension dyes in the presence of a dispersion of a solid aromatic hydrocarbon that will dissolve to the extent of at least 2 per cent. in the polymer under the dyeing conditions. C.

**Cellulose Ester or Ether Plasticizer.** American Cyanamid Co. U.S.P.2,329,015. The claim is for glycerol derivatives of the type  $\text{ArO} \cdot \text{CH}_2 \cdot \text{CH}(\text{OX}') \cdot \text{CH}_2 \cdot \text{OX}''$ , where  $\text{X}'$  and  $\text{X}''$  are H, acyl, or aromatic radicals and at least one of them is the group  $-\text{OC} \cdot \text{CMe}_2 \cdot \text{OR}$ , where R is H, an alkali metal, or an aliphatic, cycloaliphatic, aromatic or heterocyclic radical. C.

**Urea-formaldehyde Resin: Application in Stabilizing Knitted Fabric.** Röhm and Haas Co. U.S.P.2,329,651. A process for stabilizing knitted fabric against changes in dimensions or distortion, without impairing its elasticity, resilience and freedom of construction, consists in impregnating the fabric with an aqueous solution containing 8-15 per cent. of urea-formaldehyde condensate, an alcohol, and an acidic catalyst, removing excess solution so as to leave 5-12 per cent. of dry condensate in the fabric, spreading the fabric to the desired finished width, drying it, and heating it to harden the condensate. C.

**Melamine and Varnish Resin Coating Compositions.** American Cyanamid Co. U.S.P.2,329,663/4. Coated compositions comprise melamine resin and (1) manila or (2) kauri resin in proportions between 9:1 and 1:9. The melamine resin is the product of the condensation of melamine with at least 2.5 parts of formaldehyde, alkylated with an alcohol containing at least 4 C atoms. C.

**Preventing or Retarding the Formation of Precipitates in Dyeing Baths for Textiles.** I.G. Farbenind. A.-G. D.R.P.720,680 of 9/4/1942 (through *Chem. Abs.*, 1943, 37, 5255). Addn. to D.R.P.718,981 (*Chem. Abs.*, 1943, 37, 1815). Amino acids containing more than 1 carboxyl group in the  $\alpha$ -position with reference to the basic nitrogen atom are added to the dyebaths. Salts of such amino acids may also be used. These compounds are added to baths made with soft water and containing metal salts which do not tend to make the water hard. W.

**Hides: Depilating.** E. Böhme (to A. Th. Böhme, Chem. Fabrik). D.R.P. 721,885 of 7/5/1942 (through *Chem. Abs.*, 1943, 37, 5272). Hides are steeped in a liquor containing yeast cultures or autodigested yeast, a wetting agent and activators for the yeast, e.g. nitrates, sulphates or phosphates. W.

**Water-soluble Moth Repellent.** H. Schüssler (to I.G. Farbenind. A.-G.). D.R.P.722,122 of 14/5/1942 (through *Chem. Abs.*, 1943, 37, 5258). Water-insoluble hydroxy compounds of naphthalene, biphenyl or di- or triphenyl-methane containing several halogen atoms are heated in an inert solvent, together with unilateral halides of sulphocarboxylic acids. cf. D.R.P.705,433 (*these Abs.*, 1942, A 373). W.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Amylose-Glycerol Plasticizer Fibre: X-Ray Fibre Diagram.** R. E. Rundle and L. W. Daasch. *J. Amer. Chem. Soc.*, 1943, 65, 2261-2262. In the fibre diagram of amylose fibres containing a glycerol plasticizer the fibre spacing is 7.5 Å. This is very different from the 10.6 Å spacing found for the "B" modification of starch, and indicates a flexibility of the starch chain not found in the cellulose chain. Alcohol-precipitated starch, the "V" modification, has a helical structure and a periodicity along the helix of 8 Å. The optical properties of this material indicate that the greatest polarizability is normal to the helix axis, or normal to the long axis of the molecule. The greatest polarizability of the glycerol-amylose fibre is parallel to the fibre axis. The chains are probably extended linearly, rather than possessing the helical configuration of the "V"

modification, but they must be folded, less extended than in the "B" modification, as indicated by the difference in the fibre spacings. C.

**Egg Albumin Fibres: Structure.** K. J. Palmer and J. A. Galvin. *J. Amer. Chem. Soc.*, 1943, **65**, 2187-2190. X-Ray photographs are given of fibres produced from native egg albumin by a process involving precipitation of a complex of the protein and a detergent, pulling the doughy precipitate into a fibre, extracting the detergent, and elongating the resulting pure protein fibre in an atmosphere of steam. They are similar to those obtained for fibres of well oriented  $\beta$ -keratin and show that the fibres are composed of parallel bundles of polypeptide chains running parallel to the fibre axis, the chains having the  $\beta$ -keratin configuration. It is suggested that the detergent unfolds the corpuscular protein, makes possible the precipitation of the protein by addition of small amounts of inorganic salt, prevents the peptide chains from crystallising and acts as a lubricant during the initial drawing process. Tensile strength values for the pure protein fibres show that the strength increases rapidly with increase in orientation of the polypeptide chains. Fibres having a strength of 38,000 lb./per sq. in. have been obtained. C.

**Loose Cotton: Effect of Dyeing on Properties.** W. B. Griffin. *Amer. Dyes. Rept.*, 1943, **32**, 527-531, 538. Tests were made with a thoroughly blended mixture of 50 per cent. Middling and 50 per cent. Strict Low Middling,  $\frac{3}{8}$  in. staple. One portion was used as a control and the remainder was dyed sulphur navy blue, sulphur black, vat pastel blue, and naphthol red. Details of the procedures and of subsequent processing are given. A slight tendency for the dyed stock to show a decrease in mean fibre length was attributed to fibre shrinkage. There was no significant difference in fibre strength between the natural and dyed stock, except with sulphur black where a 6 per cent. decrease in strength was noted. No difference was apparent between the fineness of samples before and after dyeing. Both sulphur colours tended to produce a mild degradation. The Congo red test gave no evidence of mechanical damage. A significant increase in waste on the card was observed with all the dyed samples. This is attributed to the removal of the natural waxes, causing flats, cylinder and doffer to load more rapidly. Wider machine settings are recommended for dyed cotton. A significant increase in neps in the card web was observed with the stock dyed cotton, particularly in the heavier shades. Yarn strength was not appreciably affected by pastel vat blue and sulphur navy, whilst naphthol red tended to give an increase in strength and sulphur black produced a significant decrease. A significant increase in end breakage on the roving and spinning frames was observed with the sulphur black dyed stock. A significant decrease in the quality of the yarn appearance was observed with all the dyed cottons. Tests with two comparable batches, one of which was dyed and the other subjected to the same operations but with the dye and chemicals omitted, showed that both the dyeing procedure and the dye itself had a detrimental effect on yarn quality and manufacturing performance of the cotton. C.

**Handbook on the Quality of Indian Wool.** Agricultural Marketing Adviser to the Government of India. Marketing Series, No. 33, 1942, 49 pp. After surveying the world production and classification of wool, the characteristics of the wool fibre, and the production of wool in India, the main part of this publication deals with the physical characteristics of Indian wools and with a proposed classification. Market (185) and fleece (23) samples were examined for length and diameter of fibre, presence of kemp, crimp, and scouring loss. The results are given in a series of tables, the suitability of each sample for manufacturing purposes being stated. In the tentative classification, five main classes are suggested, *viz.*, North India Clothing, North India Rug, North India Carpet, South India Blanket, and South India Tannery, and eight sub-classes. For each class the mean fibre diameter in mm., the equivalent worsted yarn count, and the general utility are given. Details are also given of the distribution of Indian wool production according to the proposed classification. This study confirms in a marked manner the superiority in quality of North Indian wool to that produced in the South or East, and it is recommended that instead of calling all Indian wool "East Indian carpet wool" the proposed regional distinctions should be recognised and adopted by the trade. W.

**Textile Fibres and Other Substances: Phosphorescence.** H. E. Millson. *Text. Col.*, 1943, 65, 495-497, 503-506. The period of phosphorescence was measured in irradiating textile fibres and other substances, the lamp used being a 76 in. Skidmore cold quartz tube filled with a mixture of gases and also containing a small amount of metallic mercury; this lamp is especially rich in 2537A ultra-violet rays. The results are given in tables which show the effect of prior light exposure on the phosphorescence and fluorescence of undyed fabrics, and the phosphorescence and fluorescence of various dyed and undyed textile fibres, human hair, undyed paper and other miscellaneous compounds.

W.

**Ear Measurements in Relation to Pelt Thickness and Fur Characters of Karakul Lambs.** J. I. Hardy and V. L. Simmons. *J. Animal Sci.*, 1943, 2, 146-151. The ear skin thickness of 166 and the ear length of 158 purebred and crossbred Karakul lambs were measured to determine the relationship of ear measurements to pelt and fur characters. Methods of taking these measurements are illustrated. Ear skin thickness of newly born lambs was 0.93-1.87 mm. and the length 5.2-11.3 cm. There was a significant relationship between ear skin thickness of lambs and the leather thickness at the shoulder and middle back of their dressed pelts. Ear skin thickness and birth weight of lamb (size of pelt) and also size of pelt and size of curl showed a highly significant relationship. Lambs with long ears generally had fur of higher desirability than lambs with short ears. By taking simple measurements and selecting and mating together those individuals which had thin skins at birth, breeders may find it possible to develop strains of Karakul sheep capable of producing lambskins having light-weight leather.

W.

**Staple Length in Relation to Wool Production.** E. M. Pohle and H. R. Keller. *J. Animal Sci.*, 1943, 2, 33-41. Staple length, clean yield, unscoured and scoured fleece weight and body weight of 983 yearling ewes (206 Rambouillet, 281 Targhee, 251 Columbia and 245 Corriedale) were studied. The breeds included most of the common commercial grades. Body weight was also studied in relation to staple length and wool production. With each  $\frac{3}{4}$  in. increase in staple length there was an average increase of  $\frac{1}{2}$ - $\frac{3}{4}$  lb. of unscoured wool,  $\frac{1}{2}$ - $\frac{3}{4}$  lb. of bone dry scoured wool per fleece and an increase of 0.85-2.52 per cent. in clean yield. The increase in unscoured and scoured fleece weight for each  $\frac{3}{4}$  in. increase in length was greatest for Fine (80s, 70s, 64s) and Half-Blood (62s, 60s, 58s) wool. Staple length had a greater influence on clean fleece weight than any other character studied. In general, body weight had a greater influence on unscoured fleece weight than on the other characters studied. (cf. *these Abs.*, 1943, A440.)

W.

**Wool Fineness in Eight Sampling Regions on Yearling Rambouillet Ewes.** E. M. Pohle and R. G. Schott. *J. Animal Sci.*, 1943, 2, 197-208. Three locks of wool were taken from each region (withers, back, rump, shoulder, side, hip, thigh and belly), each lock being cross-sectioned near the base, at the middle and near the tip. Four groups of 50 adjacent fibre diameters were measured in each cross-section. There appears to be a trend in average fineness from the smallest average diameter at the withers, shoulder, back and side, to larger average diameters at the rump and belly, to the coarsest fibres at the thigh. An increase in the number of fibres measured beyond 100-200 decreases the standard error only slightly. Increased accuracy can be obtained most efficiently by increasing first the number of regions sampled and then the number of levels along the fibre. Samples from one level and two regions are required to obtain a standard error of 0.692, which is consistent with the range usually observed in fine wool sheep. Samples from the shoulder, side and thigh rank sheep in approximately the same order as samples from the 9 regions. For comparing individual fleeces, several regions and levels must be sampled to make differences of 2-3 microns significant at the 5 per cent. level. For comparing fleeces from groups of sheep, at least 10 sheep per group are required to make a difference of 1 micron significant for a reasonable number of regions and levels.

W.

**Rambouillet Fleeces: Clean Wool Yield Variation.** E. M. Pohle, H. W. Wolf and C. E. Terrill. *J. Animal Sci.*, 1943, 2, 181-187. Clean wool yields of

samples from withers, back, rump, shoulder, side, hip, thigh and belly were compared with one another and with yield of entire fleeces to determine variability of clean wool yield within fleeces and relative reliability of samples from various regions for predicting clean wool yield of entire fleeces. Highest clean yields were obtained from shoulder, thigh, withers and belly with yields of 39.8, 39.7, 39.6 and 39.6 per cent. of clean wool, respectively. Lowest yields were obtained from rump, side and back with yields of 31.3, 31.8 and 33.5 per cent. clean wool, respectively. Yield of clean wool for entire fleeces was 35.4 per cent. Variation among regions and among individuals was highly significant, the former being significantly greater than the latter. The highest association between small samples and entire fleece was obtained from belly, thigh, side and shoulder samples as shown by correlation coefficients. Mean yield of samples from back, side and shoulder was 35.0 per cent., which was very close to that of entire fleeces. Per cent. of clean yield obtained from a small sample of the shoulder, belly, thigh, side and possibly the back would be adequate for use in a breeding programme. W.

**Fibre Density and some Methods of its Measurement in the Fleeces of Rambouillet Sheep.** H. W. Wolf, W. M. Dawson and E. M. Pohle. *J. Animal Sci.*, 1943, 2, 188-196. Two groups of 10 sheep each were sampled in 8 body positions. In group I, 3 locks of wool were taken at each position using a Hairpin caliper; in group II, the 3 locks were taken with a Hairpin, a Wira and a Wyedesa caliper, respectively. Significant differences existed between the density of different sheep and different body positions. The order of taking the locks within a body position was not significant, although a large variation occurred within these areas. An average density of 5255 fibres per sq. cm. was found. The order of density for different positions was withers 6113, hip 6011, rump 5893, shoulder 5742, side 5611, back 4983, thigh 4105, and belly 3784. Increasing the number of sheep, the number of positions, the number of locks, and the size of the skin area from which a lock was cut all increased the accuracy of determining the fibre density. From this and other experiments, 3 sq. cm. of skin area per lock appears to be the optimum area to sample. The Wyedesa caliper appeared to be somewhat more accurate than the Wira or Hairpin calipers. Factors affecting the accuracy and the ease of sampling are discussed. W.

**Sampling Fleeces for Determining Average Wool Fineness.** J. I. Hardy and H. W. Wolf. *U.S. Dept. Agric.*, Circ. 680, 1943, 1-8 (through *Biol. Abs.*, F, 1943, 17. *Abs.* No. 24014). Sampling of fleeces from Rambouillet sheep for determining fibre fineness was expedited by mixing individual fleeces or portions thereof prior to sampling. By blending wool tops of known fineness by carding, adequate randomization was obtained even when the two components varied greatly in average diameter. Both hand and machine carding were used to randomize the fibres. Fineness of the wool was analysed by the rapid cross-sectional method. A comparison was made between different methods of sampling the wool from individual fleeces. When the fibres were not carded and were maintained in alignment, statistical analysis of the results showed a highly significant difference between fineness of fibres at different positions on the staple. These differences along the staple were, on the average, greater than sheep and area differences. Therefore it was necessary to measure the fibre at a number of positions along the staple or shift the alignment by carding. An example was given in which the wool samples drawn from a fleece differed as much as  $5.8\mu$  in average diameter. By the machine carding method, wool samples drawn from the same fleece after randomizing differed only  $1\mu$ . Although hand carding produced a good blend for small samples, machine carding was superior for handling larger amounts of wool and for precise control of time and extent of carding. W.

#### (B)—YARNS

**Cotton Yarn Standards Storage Cabinet.** *Textile World*, 1943, 93, No. 11, 138. Details and drawings are given for the construction of a cabinet with lighting system for the storage and examination of yarn wrappings against the Appearance Standards (photographs) issued by the American Society for Testing Materials. C.

**Vinyon Elastic Yarn: Properties.** Carbide and Carbon Chemicals Corporation. *Rev. Sci. Instruments*, 1943, 14, 343-344. Vinyon elastic yarn, made from vinyl chloride-acetate resin to which a special plasticizer is added before spinning, can be made with an elongation ranging from 150 to 400 per cent. of the original length. It can be covered, like latex and rubber products, or it can be used without covering for special purposes. Vinyon elastic yarn does not "snap-back" so rapidly when stretched as rubber or latex yarns. This limits the uses of the product somewhat, but tests indicate that this property results in greater comfort for restrictive apparel applications. Fatigue life and resistance to oxidation and acid perspiration are considerably greater than those of rubber. The yarn will withstand boiling in water for 12 hours without damage but continuous exposure to dry cleaning solvents and soap solutions causes stiffening. Sulphated alcohol detergents are recommended for scouring, dyeing or laundering. The temperature range through which elastic properties are available is approximately 0 to 75° C. Below this range the yarn tends to stiffen and become sluggish whilst at higher temperatures it tends to deform permanently when stretched. Generally speaking, the elasticity increases with rising temperature. C.

**Cotton Yarn: Strength; Influence of Fibre Properties.** *Rayon Textile Monthly*, 1943, 24, 635-6; 1944, 25, 20-21. The writer draws on work by Turner and his Indian colleagues, and more recent data by British and American workers, in a discussion of the relationships between fibre length, fineness and strength, twist and yarn count and strength. The loss in fibre strength on applying twist to bundles of cotton and rayon fibres is calculated and the influences of the angle of inclination,  $\theta$ , of the fibre in the (theoretical) helix and of the distance from the yarn centre are discussed. The cosine of the average fibre angle is obtained from the ratio of the length of yarn (into which twist is being inserted) to the speed of the front roller. The distribution of pressure due to twist and of strain along fibres at various points in a yarn is discussed and its effect in producing different elongations and unequal elastic limits is indicated. The following relationships are found between fibre count-strength products (C.S.P.) and Pressley (Pr.) and Chandler (Ch.) bundle strength figures:

$$\text{C.S.P. (lb.)} = \text{Pr.} \times 7.027 = \text{Ch.} \times 0.65 - 0.08;$$

also, fibre grams per denier =  $\text{Pr.} \times 0.5997$ . The influence of the percentage of fibres that end within the "zone of rupture" of a yarn is discussed with the help of Messrs. Courtaulds' data on "Fibro" ("*Fibro in the Cotton Industry*"). It is calculated that the spun rayon has about 75 per cent. of the strength of the continuous filament yarn and that about 25 per cent. of the cut fibres ( $1\frac{1}{8}$ -inch, 1.5 denier) end within a zone of rupture about  $\frac{3}{8}$ -in. wide. After allowing for the greater spread of fibre length, the writer calculates that in American Upland yarns about 45-65 per cent. of the fibre strength is realized, and recalls that Miss Clegg found similar percentages of broken ends in American yarn after rupture. The influence of yarn count and fibre fineness on the proportion of fibres that come near the surface in a yarn is also discussed. Various factors are tentatively linked together in the expression  $\text{Yarn strength} = \text{Fibre length index} \times \text{Pressley bundle strength index} \times 7.027 \cos \theta \div \text{Yarn count}$ . The fibre length index is  $100 \Sigma \{ F(L - 2x) / L \} \div \Sigma F$ , where  $L$  is the fibre length (mid-point of length frequency class),  $2x$  is the zone of rupture, and  $F$  is either the number of fibres  $\times L$  or the weight of fibre in each length class. C.

**"GreX" Yarn Count System.** American Society of Testing Materials. *Silk J. Rayon World*, 1944, 20, No. 236, 43-47. It is proposed to use as common unit for all types of yarn the "GreX" (abbreviation; gx.), which is the weight in grams of a 10-kilometre length (GRAMS PER X-kilometres). The advantages of the system are discussed, stress being placed on the fact that it is direct, the higher number corresponding with the coarser yarn. For products like ropes the "kilogrex" unit (kgx.) is suggested. A table gives conversion factors for various yarns in the grex and older systems. Thus, 100 grex is the equivalent of 59s in cotton, 90 den. in rayon or silk, 88.6s in worsted, 165.4 in linen and 49.6 in the "Typp" (thousands of yards per lb.) system. C.

**Silk, Rayon and Glass Fibre Yarns: Tensile Strength.** W. R. Wadsworth. *Textile Weekly*, 1944, 33, 275. The following figures are, in the writer's experience, representative values for the ( $\bar{d}$ ) breaking load, gms. per denier and

(b) extension at break, per cent., of yarns in the dry state:

	(a)	(b)		(a)	(b)
Net silk ... ..	3·0-4·0	15-20	Tenasco ... ..	2·7-3·0	13-15
Nylon ... ..	5·0-6·0	15-17	Visco ... ..	1·8-2·0	18-22
Durafil ... ..	5·0-6·0	6-8	Cuprammonium ..	1·8-2·0	11-13
Fortisan ... ..	5·0-6·0	6-7	Glass ... ..	6·0	4

C.

#### (C)—FABRICS

**Accelerated Weathering Tests: Standard Conditions.** H. I. Young. *Amer. Dyes. Rept.*, 1943, 32, 500-501. Details are given of standards relating to air temperature, water temperature, pressure, amount and quality, position of specimens in machine, operation of arc, and weathering cycle in accelerated weathering tests upon which agreement was reached at a meeting of representatives of the makers of the Atlas Weather-Ometer and the National Accelerated Weathering Unit, the National Bureau of Standards, the American Association of Textile Chemists and Colorists, and U.S. Army Corps of Engineers and Quartermaster-General. C.

**Light Fastness Standards: Production.** H. Christison. *Amer. Dyes. Rept.*, 1943, 32, 511-512. For standards for light fastness it is proposed to make two separate slub dye wool dyings, one fugitive and the other fast, and to blend them mechanically in proportions to produce the wanted fastness steps. Erio Chrome Azurole B, (0·4 per cent.) has been chosen for the fugitive component and Algosol Blue AGG or Indigosol Blue AGG (3 per cent.) for the fast component. Combinations have been made using algebraic percentage changes in the ratio of the two components. First, pads were made by first carding the two components for the pad material; six sets of these mats were sent to dye manufacturers, mill and school laboratories, for fading. Guided by these results, yarn was made from the blended components and sample cloth woven and finished. The cloth samples in turn have been distributed for fading and the results mounted for inspection. Advantages and disadvantages of these standards are pointed out. C.

**Soft Belt Duck: Strength Testing.** *Textile World*, 1943, 93, No. 11, 151, 160. The writer raises the question why different observers obtain different breaking loads in cloth tests and gives as his opinion that the application of too much pressure to the jaws of the machine is the principal cause of low breaks. He suggests that the pressure should be increased as the load is applied. C.

**Acetylated Celluloses: Acetic Acid Yield; Determination.** F. Howlett and Elizabeth Martin. *J. Textile Inst.*, 1944, 35, T1-6. C.

**Aeroplane Nose Fabric: Increase in Camber on Stretching.** F. B. Baker. *Practical Engineering*, 1944, 9, 179. If the fabric on the nose of an aeroplane elevator stretches there is an increase in camber. The problem of the change is worked out as an essay in geometry. C.

**Clothing Fabrics: Properties.** *Textile Research*, 1943, 13, No. 14, 21-26. A brief report is given of a symposium on the functional properties of clothing fabrics at which the speakers discussed thermal insulating properties, water vapour permeability, and water-repellency, problems involved in the study of these properties, methods of testing, and the results of recent research. C.

**Textiles: Resistance to Micro-organisms.** Canadian Government Purchasing Standards Committee. *Canad. Chem.*, 1943, 27, 480 (through *Brit. Chem. Abs.*, 1944, B II, 11). Two methods of testing the resistance are outlined. In one, a sterilised sample of the fabric or yarn is inoculated with spores of *Chaetomium globosum* and incubated on a sterile agar culture medium, being examined from time to time for growth of the fungus. In the other, the yarn or fabric is buried in a screened, composted soil and kept moist in a room at 27-29°. After a suitable period, the breaking strengths of the washed and conditioned samples are determined. W.

#### (D)—OTHER MATERIALS

**Cellulose Acetate Plastic: Repeated Impact and Fatigue Tests.** W. N. Findley and O. E. Hintz, Jr. *Modern Plastics*, 1943, 21, No. 4, 119-123. Tests were made on a clear, transparent thermoplastic material composed of medium-viscosity cellulose acetate of the acetone-soluble type, plasticized with about 26 per cent. of phthalate and aromatic phosphate ester plasticizers. Specimens  $4\frac{1}{2}$  in.  $\times$   $\frac{3}{4}$  in., with a portion of reduced width in the middle were cut from a

sheet 0.3 in. thick. The impact test was performed by causing a steel ball to fall from a fixed height and strike the end of the specimen mounted as a cantilever beam. Fatigue tests were carried out on a fixed-cantilever, constant-amplitude fatigue machine in which the specimen was repeatedly bent back and forth as a cantilever beam by a variable eccentric. Results are given in the form of curves showing stress against number of cycles for fracture, and are discussed. Failure under repeated impact resulted from progressive fracture, the same as occurred in fatigue tests. An endurance limit existed at a stress of 2160 lb. per sq. in. (the maximum stress in a cycle having a range from zero to a maximum). The endurance limit was reached at about one million cycles. The energy per blow corresponding to the endurance limit for a range of stress from zero to a maximum was less than one per cent. of the energy required to fracture a specimen in a single blow. General yielding occurred in specimens which fractured in about 12 blows or less. The straight line portion of the  $\sigma-N$  curve (log. log plot) in which fracture occurred without general yielding can be represented by the equation  $\sigma = 17,000/N^{0.143}$ , where  $N$  is the number of cycles for fracture and  $\sigma$  the maximum stress of the cycle whose range is from zero to a maximum. This equation allows the calculation of the maximum stress due to impact which may be used in design of a part which will be subjected to a given number of impact stresses during its life. The data seem to indicate that the endurance limit for repeated impact can be determined from fatigue tests. A crack was also observed to occur normal to the surface of the specimen at the point of contact with the striking ball. This crack did not appear until about 100,000 blows and did not result in fracture of the specimen.

C.

**Varnishes: Drying Rates; Determination.** H. R. Moore. *A.S.T.M. Bulletin*, 1943, No. 124, 19-29. Results are given of determinations of "set-to-touch," "dry-hard" and "dry hard-tack free" drying times of six varnishes, under ordinary laboratory conditions and in air-conditioned rooms, by 11 collaborators. A detailed analysis is made of the results and it is shown that careful control of environmental factors (temperature, relative humidity, air circulation, purity of air and lighting conditions) is of minor importance as compared with certain intrinsic factors dependent on the personal equation, namely, intensity of finger pressure per unit area contacted, duration of pressure, and cleanliness of the fingers. The absence of quantitative controls for the degree of pressure appears to account for the major lack of reproducible results by different observers. A report is also given of the results of tests with various instruments used for measuring lint-free, print-free, brush-point, tap-point, and tack-free drying times, and these results are compared with those of the finger-touch tests. The conclusion is drawn that the finger-touch tests are unsuitable as a basis for comparison of the drying rates of varnishes by different laboratories and that none of the instruments studied gives complete information on all aspects of drying of surface coatings. The development of more satisfactory methods of testing is discussed and it is suggested that the formulation of new drying time definitions should take cognizance of four primary stages of film firmness (viscosities) which can be chosen to correspond with practical requirements and with which the secondary characteristics of surface tack, pressure tack and surface hardness could be associated.

C.

**Paper: Measurement of Water Vapour Permeability.** Institute of Paper Chemistry. *Paper Trade J.*, 1944, 118, *TAPPI*, 11-17. A variation of the cup method for measuring the water vapour permeability of creased and uncreased sheet materials is described. The specimens are maintained at 100° F. with faces exposed to relative humidities of 92 per cent. and 23 per cent. respectively. The application of an electric hygrometer to the control of relative humidity in a testing room or cabinet is described and a vacuum tube amplifier control circuit which may be used with the hygrometer is shown.

C.

**Films and Paper: Creasing for Water Vapour Permeability Testing.** Institute of Paper Chemistry. *Paper Trade J.*, 1944, 118, *TAPPI*, 18-19. Creasing a protective film or paper is effected by placing the lightly folded specimen under a flat weight adjusted to exert a force of 6 lb. per in. of crease. A flat metal plate, which must be strong enough to retain its flatness under the creasing load, is employed as support. Comparisons of creased/uncreased strength ratios have shown that the severity of this laboratory creasing operation is of the same general degree as that of a good commercial bag-making operation. \* C.



**Iodine Number of Fats: Determination.** R. Montequi and A. Doadrio. *Inst. españ. oceanograf., Notas y resúmenes*, Ser. 2, 1942, No. 111, 5-31 (through *Chem. Abs.*, 1943, 37, 5263). A discussion of the methods of Hübl, Wijs, Hanus, Rosemund-Kühnhenn, Winckler, Kaufman, and Margosches, with particular attention to rapidity, precision and economy. Olive, castor, cod-liver and sardine oils were selected as the basis of comparison. The Hanus and the Kaufman methods are most generally useful; the chemicals required in these two methods can be reduced to 0.4 of the amount usually employed by operating on a smaller macro scale. The Winckler method modified by Szebellédy and Tanay (*Chem. Abs.*, 1938, 32, 7294) is useful for industrial purposes. W.

**Elaidin Reaction: Use in Investigating Oils.** A. Bömer and K. Kappeller. *Fette u. Seifen*, 1942, 49, 353-359 (through *Chem. Abs.*, 1943, 37, 5607). The melting points of the glycerides are  $\alpha$ -oleo- $\alpha$ ' $\beta$ -distearin 32.0,  $\alpha$ -elaido- $\alpha$ ' $\beta$ -distearin 60.7,  $\alpha$ -oleo- $\alpha$ ' $\beta$ -dipalmitin 27-28, and  $\alpha$ -elaido- $\alpha$ ' $\beta$ -dipalmitin 51.7. The elaidin reaction was applied to olive, peanut and soybean oils. The glycerides crystallised best from acetone, and poorly from benzene. By fractional crystallisation, olive oil yielded large amounts of trielaidin, some elaido-dipalmitin and no elaidodistearin. Peanut oil yielded principally trielaidin and stearodielaidin; a further fraction was either arachidodihypogaidin or a metamer of palmitodielaidin. Saturated glycerides were not found. The experiments indicate that soybean oil contains oleodipalmitin. W.

**Soaps and Detergents: Determining Washing Value by Rapid Laboratory Method.** T. Hesse. *Fette u. Seifen*, 1942, 49, 436-441 (through *Chem. Abs.*, 1943, 37, 5608). The washing apparatus is made of glass or porcelain with rustless rollers and air-tight cover, all housed in a thermostat. Two rollers squeeze the material and two others cause the cloth to rub on itself; three rollers give necessary changes of direction. Endless strips of cloth 2 x 80 cm., weighing 2.5 g., and soiled with a standard soil, are washed in 10 times their weight of soap solution for 1 hr. Twenty to 50 washings can be made. Soap of fixed composition (potassium or sodium soap of mixed lauric and palmitic acids—proportions not stated) is preferred as standard material. Results with this are rated 100 and others proportioned to this. W.

## 7—LAUNDERING AND DRY-CLEANING

### (A)—CLEANING

**Detergents: Evaluation.** V. B. Holland and Alice Petrea. *Amer. Dyes, Rept.*, 1943, 32, 534-537. The complex nature of detergent action is pointed out and it is stated that the usual soiled cloth-launderometer method will not suffice as a method of measuring detergency because it only measures or considers one function of a detergent which is largely its emulsifying power. Details are given of a proposed method which comprises putting a measured quantity of soil on a sample of cloth, laundering the sample under suitable conditions with the detergent in question, and then weighing the laundered sample in order to determine the quantity of soil removed by the action of the detergent. The reflectivity or brightness increase brought about by laundering is also measured and, in order to obtain a more complete picture, extraction of the washed sample may be carried out to determine the amount of oils and fats remaining after treatment with the detergent. Results obtained with sodium oleate, sulphonated castor oil, and other detergents are tabulated and briefly discussed. The advantages of the method are pointed out. C.

**Rosin: Use in Soap.** J. N. Borglin, P. R. Mosher, B. Noble and T. Punshon. *Oil and Soap*, 1943, 20, 77-84 (through *Brit. Chem. Physiol. Abstr.*, 1943, B II, 383). "Staybelite" (i.e. hydrogenated rosin), wood rosin, and gum rosin were incorporated in soaps made from white and brown tallows and coconut oil by the full-boiling process. The results are detailed of studies made on the titre, foaming power and detergent action in model washing tests in water of various hardness. In foam tests in moderately hard water, all the rosins are approximately equivalent and do not affect the sudsing power of tallow-coconut oil soaps; in soft water they maintain or improve it, but refined wood rosin is usually superior to gum rosin or Staybelite. In a white tallow-coconut oil soap, the inclusion of rosin enhanced detergency, but with the brown tallow-base soap all were less effective (effects of individual rosins are detailed). Rosin



does not, but Staybelite does, improve the solubility of high-titre white tallow-base soaps; both increase the solubility rate of moderately high-titre brown tallow or tallow-coconut oil soaps. Spray-dried soaps containing not more than 15 per cent. of rosin were practically white in colour and had no tendency to revert, discolour, or coalesce when stored at 80° F. in water-saturated air for 300 hours. C.

**Alkaline Detergent Solutions: pH Variation with Temperature.** L. E. Kuentzel, J. W. Hensley and L. R. Bacon. *Ind. Eng. Chem.*, 1943, 35, 1286-1289. Improved glass and hydrogen electrode equipment for pH determinations is described. Detailed pH data at 25°, 40° and 60° C. are presented for distilled water solutions of nine commercial alkalis used alone or in combination as laundry soap builders, namely, sodium hydroxide, carbonate, bicarbonate, tetraphosphate, metasilicate, sesquisilicate and orthosilicate, trisodium phosphate and tetrasodium pyrophosphate. A linear equation and tables of constants provide for the calculation of pH values over the range 25-60° C. for the concentrations 0.01, 0.1, and 1 per cent. to a close approximation. Thermal pH coefficients,  $\Delta pH/\Delta T$ , in general, vary little with concentration and may be applied within the above limits to calculate pH at other temperatures from any base pH measurement. Hydrogen electrode and glass electrode measurements agreed closely except for values obtained for solutions at elevated temperatures and very high pH where the sodium ion error of the glass electrode was considerable. C.

**Soap-Anionic Detergent Calcium Salts: Formation.** G. D. Miles and J. Ross. *Ind. Eng. Chem.*, 1943, 35, 1298-1301. Evidence is presented for the formation of mixed salts of calcium with fatty acids and synthetic anionic detergents. The pH limits are discussed and a plausible explanation is offered of the decrease in both the foaming and cleansing properties of mixtures of soap and sulphate detergent (e.g. sodium laurate and sodium lauryl sulphate) on addition of calcium salts. No corresponding behaviour has been observed with magnesium salts. C.

**Sodium Soaps: Wetting by Mineral Oils.** W. Galloway, I. E. Puddington and J. S. Tapp. *Canadian J. Research*, 1943, 21 B, 230-235. Sodium soaps are in general poorly wetted by mineral oils. Measurement of the contact angle of various mineral oils on surfaces of sodium soaps showed no appreciable variation with oils of varying polarity. The oils spread rapidly on soap surfaces previously wet with glycerol. As a result, mineral oils are rapidly absorbed by a soap-glycerol gel, and at the same time the glycerol is displaced and forced out of the gel. Data are given for some quantitative measurements of this preferential wetting action by various oils at elevated temperatures. The presence of free glycerol has been demonstrated in sodium soap base lubricating greases prepared from fats and alkali. C.

**Sodium Soap Dispersions: Surface Tension.** W. Galloway and I. E. Puddington. *Canadian J. Research*, 1943, 21 B, 225-229. The surface tension of sodium stearate and sodium oleate dispersions in mineral oils of high and low viscosity index has been measured over a wide range of temperature. In dispersions in non-polar oil, no surface activity is shown by the soap until the full melting point is reached. In dispersions in an oil of relatively high polarity, surface activity is shown at much lower temperatures corresponding to partial melting points of the soaps. The ability of the soap to lower the surface tension is dependent on the degree of dispersion of the soap. The relation of surface activity to physical states and phase transitions, previously determined by the authors, is discussed. The addition of glycerol increases the surface activity at a given concentration, but the temperature at which surface activity is attained remains unaffected. Excess of fatty acid acts similarly to glycerol; excess alkali decreases surface activity. C.

**Chlorohydrocarbon Solvents: Properties and Uses.** E. W. McGovern. *Ind. Eng. Chem.*, 1943, 35, 1230-1239. The inflammability, stability, effect on common engineering metals, toxicity, selective solvent action and other properties of commercially important chlorinated aliphatic hydrocarbon solvents are discussed, and a table and charts summarising physical data are presented. Applications in dry cleaning, extraction, and metal cleaning, are discussed and factors determining the selection of the individual solvents are indicated. C.

## 8—BUILDING AND ENGINEERING

### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Machine Parts: Repair by Metal Spraying.** Metallizing Engineering Co. Inc. *Textile World*, 1943, 93, No. 11, 119-121. An illustrated account is given of the steps involved in repairing worn parts and building up protective surfaces by metal spraying. Recommended tools, speeds, rate of feed of the metal, and other working data are tabulated. C.

**Machine Parts: Repair by Welding.** F. A. Westbrook. *Textile World*, 1943, 93, No. 11, 122-123. A brief illustrated account is given of the possibilities of flame hardening and arc welding in the repair of textile machinery. C.

**Metals: Protection from Corrosion.** H. B. McKean. *Paper Trade J.*, 1943, 117, TAPPI, 275-278. Causes of corrosion are discussed, and an account is given of the cleaning of metals prior to the application of preservatives and of preservative treatments for metal parts for shipment. Specifications for grease-proof wrapping materials for the treated parts are outlined and waterproof paper linings for boxes are briefly discussed. C.

**Plywood: Application in Building Construction.** F. J. Hanrahan. *Mechanical Engineering*, 1943, 65, 905-913. Timber-connector constructions with connector devices in the contacting faces of overlapped members are briefly described and the development of glued-laminated construction is reviewed. Its advantages and limitations are pointed out and typical uses are shown in photographs (roof spans, bridges, mill beams, boat keels, dome arches and a factory 830 ft. wide by 3,000 ft. long). Cost, design, and methods of fabrication are discussed. C.

**Styraloy 22 Plastic: Properties.** Dow Chemical Co. *Rev. Sci. Instruments*, 1943, 14, 343. The thermoplastic material, Styraloy 22, was developed for electrical and mechanical applications requiring low temperature flexibility and high temperature stability. Because of its excellent electrical and mechanical properties, low temperature flexibility (equivalent to rubber), and resistance to oxygen and ozone, it is suitable for ignition cable, low frequency coaxial cable, etc. A table showing some of its properties is given. C.

**Textile Mills: Construction and Equipment.** W. W. Chase and E. Mauldin. *Textile World*, 1943, 93, No. 11, 114-118. The authors offer a forecast of post-war developments in mill engineering, illustrated by such novel features as the following: (1) The single-story plant of the Carter Fabrics Corporation, built without windows, with fireproof roof and vibrationless floors. (2) The underground weaving room of the Macon (Georgia) Textiles, Inc., with air-conditioning equipment between two ceilings, and trough lighting. (3) The central-station air-conditioning plant of the Adams-Millis knitting mills. (4) An electrostatic precipitator to clean the air of a mill. (5) Danger points of scutchers painted in red against light-reflecting green for the other parts. (6) Electronic control of a stentering machine. C.

**Textile Mills: Painting.** *Textile World*, 1943, 93, No. 11, 128. A table is given in which various interior and exterior surfaces (walls, ceilings, machinery, etc.) are designated down the rows and types of paint across the columns, and suitable paints for a particular job are indicated. C.

**Timber: Water-repellent Impregnation.** A. Nowak. *Deutsche Bauzeitung*, 1942, 76, 201-202 (through *Holz Roh-u. Werkstoff*, 1943, 6, 68 and *Rev. Appl. Mycol.*, 1943, 22, 505). Wood is saturated with water-repellents, such as coal tar pitch, bitumen or ozocerite, in trichlorethylene as a solvent, the latter being recoverable. The treated wood does not swell appreciably and absorbs considerably less moisture than untreated. By reason of its comparatively dry state the impregnated wood is highly resistant to fungal damage, so that the addition of any specially toxic fungicide to the preservative is superfluous. C.

**Window Glass: Prevention of Scattering by Blast.** (1) T. R. Eilenberg and W. K. Jones. (2) F. W. Adams. *A.S.T.M. Bulletin*, 1943, No. 124, 15-17. (1) Tests were made on  $\frac{1}{4}$  in. thick plate glass panes secured in metal frames similar to window sash units in the front of a steel plate test chamber in which explosions giving a wave front simulating that of a close bomb hit were produced with mixtures of illuminating gas and air. Liquid coatings and tape bindings were found to give little protection from shattering under severe blast,

merely increasing the size of the fragments scattered. Wire glass behaved similarly. Roofing felt and similar materials pasted to the glass afforded little protection. Cheese cloth or other woven fabrics pasted to the glass held fragments together and reduced the distance to which they were thrown. A  $\frac{1}{4}$ -in. thick plywood sheet secured to a wood frame, when secured close up to the sash, was badly broken by the blast and glass fragments were blown through the openings. When the plywood sheet was moved away from the glass leaving a 6-in. wide marginal space between it and the face of the chamber, the force of the blast appeared to be dissipated through the opening and most of the glass dropped harmlessly at the base of the sheet. Heavy felt-like material and drawn venetian blinds formed unsatisfactory barriers. Wire mesh screens ( $\frac{1}{4}$ -in. mesh hardware cloth and  $\frac{3}{8}$ -in. diamond mesh chain-link wire) at a distance of about 6-in. from the glass proved effective in retaining all flying glass except fine, grain-like particles which were projected only a few feet beyond the screen. Screens made of layers of paper quilted and stitched to form a blanket, one using a heavy kraft paper, die punched and expanded to permit passage of air, and the other made of pleated tissue, freely expandable, were also effective. It is concluded that the hazard of flying glass can best be met by providing a strong, adequately fastened, resilient barrier in the window opening, so designed as to allow for the absorption and venting of the blast wave and at the same time arresting the glass fragments. (2) The explosion of illuminating gas and air at atmospheric pressure is contrasted with that of a high explosive and it is pointed out that the chamber test method, though suitable for use in the selection of barriers for stopping flying glass fragments, is not suitable for measurements of the resistance of glazing materials to explosive blast. C.

**Floor Coverings: Effects of Temperature and Humidity on Dimensions.** P. A. Sigler, R. I. Martens and E. A. Koerner. *U.S. Dept. Commerce, Nat. Bur. Standards, Building Materials and Structures Report BMS 85* 1942, 7 pp. (through *Building Sci. Abstr.*, 1943, 16, 119). The authors have investigated the effects of changes in atmospheric conditions (8-86 per cent. R.H.; 32-90° F.) on the dimensions of floor coverings of such general types as linoleum, cork, rubber, felt base, asphalt, strip wood, ply-wood, fibreboard, and monolithic compositions including cement mortar and magnesium oxychloride. Changes in relative humidity affect the dimensions of many floor coverings to a much greater extent than do changes in temperature within the range usually encountered in structures. Such floor coverings as strip wood, linoleum, and felt base show a much greater dimensional change in the across-grain or across-machine direction than in the grain or machine direction. The several monolithic compositions showed relatively small changes in dimensions. C.

**Weaving Mill: Buttrressing to Reduce Vibration.** *Textile World*, 1943, 93, No. 12, 88. An illustrated account is given of a serious case of vibration in a mill that occurred after installing new fast looms on the second floor (counting the ground floor as No. 1). The vibration in the spinning room on the fourth floor could not be cured by bracing the machines and eventually it was necessary to buttress the walls from outside, up to a point just above the floor of the weaving room. C.

#### (D)—POWER TRANSMISSION

**Belt Drives: Application.** *Silk & Rayon*, 1944, 18, 100-102, 210-211. A practical account of the types of driving belts, their dimensions and power transmission, pulleys and belt sizes, and tensions. C.

**Textile Machinery: Lubrication.** *Textile World*, 1943, 93, No. 11, 126-127. A table is given in which the various lubricating points (41 in all) of combing, spinning, winding, sizing, weaving, knitting, calendering and stentering machines appear down the rows with oil and grease characteristics (viscosity or worked penetration) across the columns, and suitable lubricants for a given purpose are indicated and verbally described. C.

**Leather V-shaped Driving Belts: Advantages.** E. L. Parry. *Textile Weekly*, 1944, 33, 288. A brief announcement of the belting made by the Benson Vee Leather Co. Ltd. (Bradford). The angle included between the side planes of the standard forms is 28 or 40 degrees and the material is supplied in the form of endless belts or in rolls 20, 50 or 100 feet long, already stretched. V-belts combine the advantages of flat belts with ability to work on extremely short centres. C.

**Textile Machinery: Lubrication.** R. G. Shepherd. *Textile World*, 1943, 93, No. 12, 76-77. The writer emphasises the importance of friction as a cause of fires in spinning and weaving rooms, and gives advice on routine lubrication, the storage of lubricants, and inspections and records. C.

(E)—TRANSPORT

**Machinery Transporting Devices.** *Textile World*, 1943, 93, No. 11, 124-125. Practical hints are given on the steps to be taken when a machine has to be moved, with illustrations of suitable tools and skids. C.

(G)—HEATING, VENTILATION AND HUMIDIFICATION

**Centrifugal Dust Collectors.** L. C. Whiton. *Mechanical Engineering*, 1943, 65, 885-888. A tubular type of centrifugal dust collector consists of a large number of steel tubes of  $6\frac{1}{2}$  in. diameter which are placed between tube sheets. Inlets to the tubes for the gas consist of heavy steel plate welded to an upper and lower disc. The gas is rotated within the tubes after it enters the flared inlets, thus precipitating the dust by centrifugal force, and the clean gas issues through  $4\frac{1}{2}$ -in. diameter central tubes. A similar dust collector has been developed having fire-clay ceramic tubes, reinforced concrete tube sheets, and brick or reinforced concrete side walls. Specifications for ceramic tubes are given and the construction and assembly of the ceramic tubes are described. Photographs and diagrams are given and the relative efficiencies of steel and ceramic dust collectors are discussed. C.

**Air Conditioning Plant: Selection.** D. P. Stimson. *Rayon Textile Monthly*, 1943, 24, 661-663. The author discusses the principles of air conditioning involved in the consideration of suitable plant and points out the limitations and advantages of the evaporative cooling system, ductless and dry duct systems, central stations, and unitary systems. A note is added on air cleaning by electrostatic deposition on collector plates smeared with a viscous film. C.

**Dust Extraction and Air Filtration Plant: Design and Control.** W. J. Ellison. *Textile Weekly*, 1944, 33, 244-9, 285-6. A report of a lecture on the principles, advantages and disadvantages, and common errors in working, of air cleaning by (1) the use of dust settling chambers, (2) centrifugal or cyclone action, (3) impingement, (4) filtration, (5) electrostatic precipitation and (6) wetting. Under (4) the lecturer recommended a cloth with  $4\frac{1}{2}$  ends and picks per inch of  $22\frac{1}{2}$  yarns for filter sleeves or bags; this provides a free air space of about 0.01 inch between the yarns, or a ratio of air space to cloth area of 0.25. At least 1 sq. ft. of cloth should be used for every 5 cubic ft. of air per minute. A scale model of one element of a dust removal plant installed by Messrs. Turner Bros. Asbestos Co. Ltd., Rochdale, is described with illustrations of the filter bags and automatic means for shaking them at predetermined intervals. A discussion is reported, in which the lecturer gave as a useful formula for calculating air velocity in feet per minute (A.V.) from the reading of a Pitot tube in inches (P.t.),  $A.V. = 1000\sqrt{16 \times P.t.}$ . C.

(H)—WATER PURIFICATION

**Boiler Water Alkalinity Indicator.** H. Fleisher. *Ind. Eng. Chem. (Anal. Edn.)*, 1943, 15, 742-743. A sensitive indicator for use in the determination of the alkalinity of boiler water is prepared by dissolving 0.45 gm. of methyl red sodium salt and 0.55 g. of alphazurine in 1 litre of distilled water. The pH of the solution is approximately 7.3. The colour changes from greenish gray to gray at pH 4.8 and from gray to purple-gray at pH 4.6. The gray intermediate colour gives ample warning of the approaching purple gray which is used as the end point of the titration. C.

(I)—WASTE DISPOSAL

**Rayon Factory Waste Water: Treatment.** I. D. Yashin. *Vodos. sanit. Tekh.*, 1941, 16, No. 6, 45 (through *Chem. Zentr.*, 1942, ii, 1948 and *Water Pollution Res. Summ. Current Lit.*, 1943, 16, 29). Waste water from rayon factories consists of three portions: (1) acid, (2) alkaline, and (3) amounting to 7 per cent. of the whole, contains fibres and has a B.O.D. of 3800-5000 mg. of oxygen per litre. This part also contains more than 3000 mg. of sodium hydroxide per litre, as well as dissolved  $\alpha$ - and hemi-celluloses. Experiments have shown that organic matter is precipitated only after neutralisation. With the pH value adjusted to 2.5 to 3.0 precipitation of the organic matter begins

within 25 to 30 min. and is complete after a further 15 to 20 min. A reduction in B.O.D. of 20-40 per cent. occurs. Of the supernatant liquid, 70 per cent. can be discharged to a stream, but the rest must first be passed through filters of sand and gravel. A description is given of a proposed plant in which the acid portion of the waste water is used to neutralise the alkali in the portion containing fibres and in which the remainder of the waste water is passed through dolomite filters, with a filtration rate of 6.5 m. per hour. The filtering material has a depth of 220 cm. and the grains are 25 mm. in diameter. The sludge obtained by precipitation is dried and the supernatant liquor is treated with 100 mg. of chlorine per litre. C.

## 9—PURE SCIENCE

**Starch-iodine Complex: Composition.** R. R. Baldwin. *Iowa State Coll. J. Sci.*, 1943, 18, 10-12. The absorption spectrum of starch-iodine is similar to that of the iodine complex of cyclohexa-amylose the structure of which has been established as a six-membered cyclic glucose polymer enclosing an iodine molecule. Starch-iodine solutions show a definite dichroism of flow which is such that the iodine molecules involved in the complex must have their long axes parallel to the length of the starch molecule. Optical studies of crystalline amylose-iodine complex make any but a helical configuration of amylose unfeasible. X-Ray patterns of the amylose-iodine complex are in accord with a helical configuration with six glucose residues per helix turn. A comparison of the absorption curves of iodine in non-polar solvents and in starch discredits the hypothesis that the blue colour of the starch-iodine complex is due to iodine merely dissolved in the hydrocarbon lining of starch in a helical configuration. A more tenable explanation of the increased absorbing power of iodine in starch is based upon the orientating influence of the starch helix on iodine molecules and the interaction of the iodine molecules aligned in the helix. Iodine is taken up more readily by amylose than by amylopectin. From the difference in light absorption qualities of amylose-iodine and amylopectin-iodine it is possible to estimate quantities of these materials present in starches. Relationships exist between the chain length of starch and the absorption maximum of the corresponding iodine complex and between the degree of branching in starch and the absorption maximum of the complex. A shift to shorter wave lengths occurs with an increase in amount of branching and a shift to longer wave lengths with an increase in chain length. The colour of a starch-iodine complex is thus not a function of molecular weight, but a function of the length of straight chains or the length of the longest branches present in the starch molecule. C.

**Proteins: Periodic Structure.** A. G. Ogston. *Trans. Faraday Soc.*, 1943, 39, 151-158. A polypeptide chain is regarded as an "array" of "places" to be filled by units (various amino-acids), each sort of unit occurring in the array at regular intervals. The two necessary conditions that must be satisfied by a regular array are—(1) that no two series are congruent, that is, that units from no two series are required to occupy the same place in the array and (2) that all places in the array are occupied. These two conditions are examined, and the structure and permutations of an array are discussed. A simple diagrammatic method of testing for regularity is illustrated. It is shown that interval values calculated from published analytical data for gelatin and edestin indicate that these proteins cannot be in the form of regular arrays. Reference is made to the hypotheses of Bergmann and Niemann, and it is pointed out that the present study provides no suggestion that 2 and 3 hold any unique position as prime factors in the structure of a regular array of the type considered. C.

**Diazo-oxides: Constitution.** H. H. Hodgson and E. Marsden. *J. Soc. Dyers & Col.*, 1943, 59, 271-275. Previous views on the constitution of the diazo-oxides are critically examined. The colour, solubility, stability, explosive character and coupling of the diazo-oxides (including the *peri*-naphthalene compounds) are readily explained by resonance conceptions. The non-existence of *m*-diazo-oxides is also explicable by modern electronic theory. Replacement of groups, e.g. the nitro-group and the halogens, by hydroxyl is shown to be a two-stage process, viz., diazotisation, followed by attack by anionoid water at the relevant carbon atom. The comparative stabilities of the  $-N:N.S-$  and  $-N:N.O-$  groups are discussed. Facile replacement of the diazo group in the diazo-oxides by hydrogen affords evidence of diazonium structure, and ephemeral

double salt formation in alcoholic zinc chloride and antimony chloride solutions removes one of the objections to this structure. The conclusion is drawn that the diazo-oxides are not compounds cyclised by the  $-N:N.O-$  group, but resonance hybrids. C.

**Sulphydryl Compounds: Application to Hinder Rancidity.** P. György, E. T. Stiller and M. B. Williamson. *Science*, 1943, 98, 518-520. Experiments with dried milks have shown that thiourea is capable of acting as a fat antioxidant, but only in the presence of water. The antioxygenic properties of thiourea  $[(NH_2)_2C:S]$  can be attributed to the sulphydryl residue in its tautomeric form, isothiurea  $[NH_2.C(SH):NH]$ , which carries with it the following implications:

(1) Iso-thioureas having a substituent attached to the S atom should not exhibit antioxygenic properties, but N-substituted thioureas having a hydrogen atom available for enolization should be active. (2) Other sulphydryl compounds, e.g. cysteine (but not cystine), should also be good antioxidants, at least *in vitro*. (3) Copper and ferric ions should inhibit the antioxygenic potency of sulphydryl compounds. The results of experiments to test these postulates are tabulated and discussed. The data confirm the correctness of the assumption that sulphydryl compounds by virtue of their free sulphydryl radical retard the development of rancidity in fat, but only in the presence of water and in the absence of copper salts (also of ferric salts, and possibly of other inhibitors of the sulphydryl radical). It is improbable that the effect of the copper salt is due to its inherently pro-oxygenic character rather than to its effect in blocking the sulphydryl group. The strong antioxidant, hydroquinone-mono benzyl ether, is not inactivated by the copper ion. C.

**Colloidal Solutions, Pigment Suspensions and Oil Mixtures: Rheological Properties.** R. N. Weltmann and H. Green. *J. Applied Physics*, 1943, 14, 569-576. Viscosities of resin, ethylcellulose, nitrocellulose and chlorinated rubber solutions were determined at higher solid contents than those previously used in testing the applicability of Arrhenius's law. Although this law was not obeyed, a similar exponential law could be applied. With pigment suspensions at concentrations where plasticity occurs, Arrhenius's law was not valid but two similar exponential relations were established between (a) the plastic viscosity and (b) the yield value, on the one hand and the volume per cent. of pigment content of a plastic suspension on the other hand. The two constants in the exponents of the two equations are logarithmically related to the average diameter of the pigment particles contained in the suspension. Oil mixtures were tested below a certain rate of shear (the limiting rate of shear), where they are Newtonian liquids, and also above this limiting rate of shear where they behave like thixotropic plastics. Their Newtonian viscosities, obtained at rates of shear below the limiting rate of shear, were found to increase logarithmically with the volume per cent. of one of the oils contained in the mixture, in agreement with Arrhenius's exponential law. Above the limiting rate of shear, deviations from the exponential law were observed. C.

**Thermoplastic Polymers: Softening.** R. F. Tuckett. *Trans. Faraday Soc.*, 1943, 39, 158-168. The general deformation produced in an amorphous high polymeric material by a given stress is analysed into its three components, "ordinary elastic," "highly elastic" and "viscous." These all have different dependencies on molecular size, structure, temperature and duration of stress. The effect of these variables is worked out and the information obtained is used to analyse the various empirical softening point tests that are in current use to characterise plastics. Such tests fall into two main groups: (1) Those which measure the flow properties of materials and, as such, are of use in evaluating correct moulding conditions. (2) Tests that measure the temperature at which high elasticity develops—this is important in assessing heat distortion properties of the material under working conditions. A typical flow-property test, the modified Kraemer-Sarnow, is analysed further and, on the assumption that softening points of this type are essentially iso-viscous states, a relation between molecular size and softening temperature, based on Flory's relationship, is predicted and shown to hold experimentally in the case of the polyvinyl acetates. Deviations that occur with other materials are explained qualitatively. A critical survey of several recent estimates of polymer viscosities is made, it being shown that the viscous properties of such systems have often been confused with highly elastic ones. C.

**Infra-red Spectroscopy: Industrial Applications.** R. B. Barnes, U. Liddel and V. Z. Williams. *Ind. Eng. Chem., Anal. Edn.*, 1943, 15, 659-709. The origin of infra-red spectra and the intensity of infra-red absorption bands are discussed. Qualitative and quantitative applications of infra-red spectroscopy are described, details are given of the experimental equipment and technique, and the present status of infra-red spectroscopy in industry is reviewed. Transmission curves are given for 363 organic compounds including various hydrocarbons, alcohols, ethers, carbonyl compounds, nitrogen compounds, terpenes and organic chlorides. C.

**Colour: Perception and Photography.** R. M. Evans. *J. Optical Soc. America*, 1943, 33, 579-614. A study of brightness relations, colour adaptation and colour constancy, and the effect of adaptation level, in relation to colour photography under the following headings:—luminance versus brightness in photography, brightness constancy in nature, photography of brightness constancy phenomena, visual adaptation for colour, general colour adaptation-colour constancy, lateral colour adaptation-simultaneous colour contrast, local colour adaptation-successive colour contrast, indeterminacy of colour perception, the problem of chromaticity reproduction, reproduction of simultaneous contrast effects, effect of viewing conditions on the apparent quality of reproduction, nature of the adaptation process, brightness perception under colour adaptation, possible calculations of colour perception, photography at different luminance levels, relative brightness reproduction errors, and the effect of viewing conditions. C.

**Small Colour Differences: Graphical Representation.** W. D. Wright. *J. Optical Soc. America*, 1943, 33, 632-636. The author compares the results of his investigations of sensitivity with those of MacAdam's study of colour matching. The two sets of results are in generally good agreement and confirm the marked lack of uniformity of the International Commission on Illumination chromaticity chart. Some differences between the two investigations are, however, pointed out, and evidence is given of personal variations in the colour discrimination function. It is suggested that it would seem better to be satisfied with a linear projection of the I.C.I. chart giving only approximate uniformity of colour distribution than to resort to non-linear projections. C.

**Cross-linked Polymer Networks: Elasticity.** P. J. Flory and J. Rehner, Jr. *J. Chem. Phys.*, 1943, 11, 512-520. A model is proposed for the structure of a cross-linked network, such as exists in a vulcanized rubber, which is amenable to statistical treatment. Expressions are derived for the structural entropy of the network, and for the entropy change on deformation. The latter is in agreement with the relationship derived by Wall and others by a different treatment. C.

**Insecticidal Dusts: Structure and Properties.** H. V. A. Briscoe. *J. Roy. Soc. Arts*, 1943, 91, 593-607 (through *Brit. Chem. Physiol. Abstr.*, 1943, B III, 296 and *Analyst*, 1944, 69, 60). A physico-chemical study is made of the mechanism of the action of finely-divided mineral powders ("inert dust insecticides") on the grain weevil and other insects infesting stored foodstuffs. The dusts operate by promoting loss of body-water from the cuticle, the insect being slowly killed by desiccation. The killing powers of different dusts run parallel with their capacities for enhancing evaporation in this way. An effective dust is composed of an intrinsically hard material, and contains a substantial proportion of particles less than  $10\mu$  in diameter; the optimum particle size is  $2\mu$ . The method of preparation of the dust is important; in many cases a product obtained by dry grinding is markedly inferior to one prepared by grinding under a liquid. The difference is due, not to differences in particle size distribution (although these exist), but to structural features of the particles, possibly the formation of a less effective surface similar to a Beilby polish layer during dry-grinding. Similar changes of effectiveness are observed when dusts are given various superficial chemical treatments. In some cases powders differing in effectiveness against weevils appear to be indistinguishable by any physico-chemical method. A tentative explanation of the action of inert dust insecticides is based on experiments with an artificial model of insect cuticle; a dusting effect similar to that observed with insects was obtained with a celluloid membrane coated with a thin film of wax. C.



**Celluloid Membranes: Transpiration of Water; Effect of Waxes and Inorganic Powders.** P. Alexander, J. A. Kitchener and H. V. A. Briscoe. *Trans. Faraday Soc.*, 1944, 40, 10-19. An apparatus has been devised to measure accurately the rate of diffusion of water through relatively impermeable membranes, such as celluloid, into air. The rate is found to be independent of small hydrostatic pressures. The rate of evaporation from celluloid is considerably reduced when extremely thin films of various fatty substances are applied to the celluloid. Natural waxes are particularly active in this respect. This supports the idea that the natural waxy layers present in the epicuticle of insects and the epidermis of plants are responsible for water conservation. Finely-divided, inert, inorganic powders such as carborundum have no effect on the evaporation from a clean celluloid film, but increase that from one coated with a water-resistant fat film. The system studied was intended to simulate the process by which inert dust insecticides operate, and appears in many ways to exhibit parallel behaviour. (See Section 8A, above.) C.

**Starch: Amyolytic Degradation.** W. N. Howarth, H. Kitchen and S. Peat. *J. Chem. Soc.*, 1943, 619-625. It is shown that  $\beta$ -amylase hydrolyses the amylopectin component of starch with the formation of maltose and a limit dextrin: dextrin-A or  $\alpha$ -amylodextrin. Dextrin-A is not susceptible of further attack by  $\beta$ -amylase until it has been "sensitised" by contact with salivary amylase. Thereafter the action of  $\beta$ -amylase continues until a second resting stage (dextrin-B) is reached. Dextrin-B is not further hydrolysed by  $\beta$ -amylase or sensitised by saliva, but is hydrolysed by salivary amylase with the production of maltose and dextrin-C. This dextrin is slowly hydrolysed by pancreatic amylase with the formation of dextrin-D. End-group assay on the methylated dextrans indicates that the unit chain-lengths are B 7-8, C 5-6, and D 4-5. The mechanism of amyolysis can be explained on the basis of the simple laminated formulation of the structure of starch (Haworth and Hirst) if it is assumed (i) that the impediment to  $\beta$ -amylase action is represented by the polymeric links which unite the unit chains; (ii) that the polymeric links are ruptured by an enzymic constituent of saliva and of malt  $\alpha$ -amylase; and (iii) that the unit chains so liberated immediately combine again with the formation of new polymeric (i.e. 1:6- $\alpha$ -glucosidic) links with a different orientation of position on the respective chains. It is not necessary to postulate a complex highly ramified structure for amylopectin to explain the facts of amyolysis. C.

**Pentosans: Determination.** R. G. Cooke. *Paper Trade J.*, 1943, 117, TAPPI, 32-35. The method for the determination of pentosans that depends on determination of the furfuraldehyde evolved on distillation with 12 per cent. hydrochloric acid has been subjected to a kinetic study, and the curves showing pentosan content against volume of distillate or time are analysed mathematically. On the basis of the results, proposed modifications and corrections are critically discussed and a rapid method for obtaining reliable values is suggested. C.

**Kaolin: Effect of Heating.** G. F. Hüttig and E. Herrmann. *Kolloid Z.*, 1940, 92, 9-35 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 305). Measurements of solubility in hydrochloric and sulphuric acids, and of sorption of methyl alcohol, hydrochloric acid, sulphur dioxide and dyes, are recorded for preparations of kaolin after treatment with air, water vapour, oxygen, nitrogen, nitrogen peroxide, hydrogen chloride and sulphur dioxide at various pressures and temperatures up to 700°. The order of decreasing catalytic activity for dehydration of kaolin in the presence of gases is ( $\text{NO}_2$ , HCl),  $4\text{NO}_2 + \text{O}_2$ ,  $\text{O}_2$ ,  $\text{N}_2$  (inactive), water (inhibitory). Water acts by displacing the equilibrium. C.

**Wood Cellulose: Depolymerisation during Delignification.** S. Coppick. *Paper Trade J.*, 1943, 117, TAPPI, 269-271. The depolymerisation of wood cellulose during delignification may be followed by nitrating samples of the material, extracting the cellulose nitrate with alcohol and determining its chain-length viscometrically. This method has been used in a study of the depolymerisation of cellulose during a series of sulphate and soda cooks as well as during chlorine dioxide and Cross and Bevan delignifications. In soda and sulphate cooking, depolymerisation takes place continuously and uniformly. In chlorine dioxide and Cross and Bevan treatments, delignification appears to be preceded by fractional solution of the short-chain carbohydrate, resulting in an increase in the average chain-length of the residual cellulose which is further



depolymerised as delignification proceeds. The total degradation in chlorine dioxide pulping is considerably less than that found for soda or sulphate delignification, and with the chlorine treatments followed by sulphite digestions the "over-all" degradation is midway between that found for the chlorine dioxide and the pressure cooks. Considerable depolymerisation takes place in the hot grinding operation of mechanical pulping. The chain length of cellulose as it exists in wood appears to approach that of raw cotton. C.

**Butanol-precipitated Amylose and Starch-Iodine Complex: Structure.** R. E. Rundle and F. C. Edwards. *J. Amer. Chem. Soc.*, 1943, **65**, 2200-2203. Diffraction patterns from wet and dried butanol-precipitated amylose confirm a helical starch chain with a helix diameter of about 13.7 Å., a length per turn of about 8 Å., and six glucose residues per turn. The helices approximate to a close-packed arrangement in both the wet and dried precipitates, with alternate helices directed in opposite directions. The space group for both structures is probably  $D_{2d}^4-P_{2,2,2}$ . The spatial relations between the starch-iodine complex and the dried butanol precipitate confirm the proposal that in the starch-iodine complex the iodines occupy the interior of the helices, and it is suggested that in butanol-precipitated amylose the butanol occupies the interior of the helix. The cell previously reported for the starch-iodine complex must be a pseudo-cell with only pseudo-hexagonal symmetry. C.

**Fats: Oxidative Rancidity.** T. P. Hilditch. *Chemistry and Industry*, 1944, 67-71. Antioxidants accompanying fats in seeds are discussed. A common feature of them is the presence of one or more polyhydroxyphenyl residues or ring systems forming part of a more complex molecular structure. Possible explanations are suggested for the fact that none of the natural antioxidant extracts or individual components when isolated exhibits antioxygenic activity comparable with the efficiency displayed within the seed itself. A brief survey is made of the various methods in use for measuring the development of oxidative rancidity. The results of recent investigations of the action of antioxidants on fats in different physical states, relative efficiencies of various antioxidants in different systems, antioxidants in the conservation of vitamin-A in fats, and the specificity of antioxidants towards different types of organic compounds are reviewed. Data showing the protection afforded by various antioxidants in dry fat, margarine emulsion, a dilute aqueous fatty acid suspension and an ethyl acetate solution of carotene, and the protective action of antioxidants on vitamin-A in halibut liver oil and margarine, are given. The results show that the presence of a carboxylic group in a phenolic molecule reduces antioxidant activity but, on the other hand, the synergistic effect of certain acids on the antioxidant power of polyhydroxyphenols has been confirmed. Differences in the physical state of a fat may have a profound influence on the efficacy of one or other added antioxidant and different antioxidants may behave differently in regard to differing kinds of unsaturated groupings in the substrate molecule. Practical applications of antioxidants in the storage of dried milk, meats and eggs and anhydrous fats are discussed. C.

**Electrodialysis-electrophoresis Apparatus.** O. Dahl. *Kolloid Z.*, 1940, **92**, 70-75 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 307). A three-chamber apparatus consisting of anode- and cathode-cells and electrodialysis-electrophoresis vessel is described. It permits simultaneous electrodialytic purification and electrophoretic fractionation of colloidal systems. Fractionation results for separation of amylose and amylopectin from starch are given. C.

**Insoluble Monolayers: Properties.** A. E. Alexander. *Reports on Progress in Physics*, 1942-43, **9**, 158-176. The principal experimental techniques used in the study of insoluble monolayers at the air-water interface are outlined and a survey is made of progress in the study of phase changes in monolayers, the use of the monolayer technique in elucidating molecular structure, built-up films or multilayers, evaporation through monolayers, the application of results of studies of monolayers to problems of adsorbed films such as the surface-ageing phenomenon, the Gibbs adsorption equation and the structure of surfaces of solutions, and insoluble monolayers at the oil/water interface. C.

**Soap Solutions: Conductivity.** (1) E. Angelescu. (2) E. Angelescu and A. Woinarosky. *Kolloid Z.*, 1940, **92**, 94-98, 99-105 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 305). (1) Factors affecting electrical conductivity in colloidal electrolyte solutions, e.g. soap solutions, are reviewed. Soap solutions with

addition of various proportions of cresols provide suitable systems for the study of the effect of ionic dispersity and solvation on conductivity. (2) The conclusions of the foregoing paper are tested by measurements of the conductivity in Na and K stearate and palmitate solutions at concentrations 0.1 and 0.2N. and temperatures of 20-60°, with and without addition of *o*-cresol. All four soaps show a maximum value of conductivity with increasing cresol concentration; the maximum is the more pronounced the greater is the colloidal character of the soap, and its form is independent of concentration and temperature. The effect of CH<sub>2</sub>-chain length is greater than any effect of differing ionic mobility or dissociation constant. The effect of change of cation is marked with stearates but inappreciable with palmitates. The effect of dilution is inappreciable except with sodium stearate, for which equivalent conductivity increases with dilution. C.

**Colloidal Electrolytes: Osmotic Activity.** J. W. McBain and A. P. Brady. *J. Amer. Chem. Soc.*, 1943, **65**, 2072-2077. Freezing point lowering data and osmotic coefficients are presented for N-(lauryl-colamino-formyl-methyl)-pyridinium chloride, ammonium Aerosol OT, and mixtures of potassium laurate and chloride or sulphate. These and other published data for osmotic coefficients of colloidal electrolytes are brought into coincidence on one of three curves, by merely changing the scale of concentration. There is one curve for straight-chain compounds, one for branched and one for polycyclic colloidal electrolytes. The osmotic and conductivity data indicate the presence of a small proportion of highly conducting micelles in very dilute solutions, a conclusion which is supported by previously published migration data. The addition of potassium chloride or sulphate to very dilute solutions of potassium laurate promotes the formation of colloid, so that the result is distinctly less than additive; in higher concentrations where the colloid is already formed, the effect on freezing point lowering is slightly more additive. There is no marked indication of high ionic strength in solutions of colloidal electrolytes. It is possible to obtain the value of the activity coefficient of a straight or branched chain colloidal electrolyte with fair accuracy from a single freezing point determination. C.

**Atmospheric Oxygen: Photochemistry.** S. Chapman. *Reports on Progress in Physics*, 1942-43, **9**, 92-100. An outline is given of attempts made to account for the presence of the abnormal atomic and triatomic forms of atmospheric oxygen. C.

**Oxygen-Nitrogen Atmosphere; Photochemical Processes in —.** C. H. Bamford. *Reports on Progress in Physics*, 1942-43, **9**, 75-91. A survey of progress in the study of the photochemistry of oxygen, ozone and the oxides of nitrogen, photo-reactions in oxygen and oxygen-nitrogen atmospheres, the photolysis of water and hydrogen peroxide, and reactions between hydrogen and oxygen, and hydrogen and nitrogen. C.

**Dyes: Absorption Spectra and Electronic Structure.** G. N. Lewis and J. Bigeleisen. *J. Amer. Chem. Soc.*, 1943, **65**, 2102-2106. When one of the three equivalent groups of crystal violet is replaced by a different group, the single absorption band is resolved into  $\alpha$  and  $\gamma$  bands. The separation is greater the more the new group differs, as an auxochrome, from the old. The electronic oscillations of the two excited states are perpendicular to each other. The negative fluorescent polarizations found by Wawilow in fluorescein and rhodamine-B are discussed and shown to be in accord with Lewis and Calvin's theory of this phenomenon. The second band of malachite green is proved to be the  $\gamma$  band by two methods. The first depends on the production of orientated molecules in a rigid solvent. The second, which has also been applied to another similar dye, is the method of polarized fluorescence. A new method of viewing and measuring small degrees of polarization is described. C.

**Dyes and Cyanines: Absorption Spectra and Electronic Structure.** G. N. Lewis and J. Bigeleisen. *J. Amer. Chem. Soc.*, 1943, **65**, 2107-2110. Additional second order  $\alpha$  bands have been found in the absorption spectra of the cyanines and numerous dyes. For the latter group it has been necessary to make use of an extended potential diagram for electronic oscillations. In this group, the diagram leads to the conclusion that the ratio of the second order frequency to the first order frequency should increase as the first order frequency diminishes. This has been found to be true experimentally. C.

**Isocyanine Dyes: Absorption Spectra.** G. Scheibe. *Z. Elektrochemie*, 1941, 47, 73-80 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 297). Previous work on  $\psi$ -isocyanine diethochloride in aqueous solution is reviewed. As concentration is increased, a new absorption band appears at a definite concentration. It is very narrow, and of longer wave length than the bands normally given by this compound, and is accompanied by resonance fluorescence. When diluted or warmed the solution loses this absorption. Similar phenomena are shown by mixtures of these dyes with others. The new narrow band appearing in this case is not characteristic of either component, but is intermediate in wave length, and must indicate the formation of a new absorption complex. Several series of compounds related to  $\psi$ -isocyanine diethochloride have been prepared, and their absorptions determined. Replacement of methyl by ethyl on the nitrogen of simple  $\psi$ -isocyanines produces very little shift of the principal absorption band, but with the trimethyl derivative of  $\psi$ -isocyanine diethochloride, replacement of NMe by NEt in the substituted quinoline ring causes considerable displacement towards the red. A similar replacement in the unsubstituted quinoline ring, however, has very little effect. This is due to steric hindrance. These and effects of a similar kind observed with related dyes are considered in connexion with the polarisation of light reflected from and absorbed by the molecules. C.

**Organic Compounds: Ultra-violet Absorption Spectra and Constitution.** M. Pestemer. *Z. Elektrochemie*, 1941, 47, 20-28 (through *Brit. Chem. Physiol. Abstr.*, 1943, A I, 296). The possibility of using ultra-violet absorption spectra to determine the constitution of organic molecules is discussed. Groups of conjugated chromophores can readily be recognised in a molecule when limited by  $\text{CH}_2$  groups. The position of chromophores with respect to each other, and of substituents, gives rise to characteristic differences in the ultra-violet absorption spectrum. Examples drawn from *cis-trans* isomerism, tautomerism, chain-conjugation of chromophores, the nature of condensed rings in hydrogenated and dehydrogenated isocyclic hydrocarbons, and the detection of definite amino-acids in proteins are given. C.

**Sun: Far Ultra-violet Spectrum.** A. Hunter. *Reports on Progress in Physics*, 1942-43, 9, 5-9. Attempts to investigate the spectrum of the sun in the far ultra-violet by direct observation below 2900 Å., by inferences from direct observations above 2900 Å., and by indirect observations are reviewed. It is pointed out that neither direct observation nor theory can at present be used to deduce the distribution of solar radiation below 2900 Å. Many phenomena of widely different kinds, however, combine to suggest that the sun radiates much more energy in the far ultra-violet than would a black body at 6000° K. Super-excitation in the solar chromosphere, in comets, and in the earth's upper atmosphere suggests that at various wave lengths between 1000 Å. and 200 Å. radiation corresponding to temperatures up to 20,000° K. is leaving the sun. The number of wave lengths at which the presence of such excess radiation is indicated suggests that the solar spectrum effective in producing these different phenomena is a continuum; but in addition to this, line emission in the principal series of H, HeI and HeII must take place from the chromosphere at all times, and (as regards H and HeI) must be multiplied many thousandfold during the transitory chromospheric eruptions. Especially marked should be the emission at 1215 Å. and 584 Å., due to H and He, respectively. C.

**Water Vapour: Far Infra-red Absorption.** T. G. Cowling. *Reports on Progress in Physics*, 1942-43, 9, 29-41. The internal motions of the water molecule, absorption and emission, line breadths, absorption by a line spectrum and its variation with pressure and temperature, and steam absorption are discussed, and observations of the total absorption and the absorption at different wave lengths of damp air are reviewed. C.

**Electron Microscope: Construction and Application.** W. Wilson. *Electrical Review*, 1944, 134, 218-222, 254-257. A straightforward account is given of the principles of the electron microscope, the standard model of the Radio Corporation of America and the portable model of the General Electric Co. of America are described, hints are given on the mounting of specimens for examination, and some typical electron micrographs are reproduced, including one of Vinylite which demonstrates the great depth of focus characteristic of electron microscopy. C.

**Plastics: High Frequency Heating.** G. Dring. *British Plastics*, 1944, 16, 13-26. Difficulties arising in conventional moulding processes as a result of lack of heat conductivity in moulding materials are pointed out and the advantages of the "heatronic" moulding process are described. The material is pre-heated by placing it between the plates of a condenser to which a high frequency alternating potential is applied. This method makes possible a shorter curing time and increased power of flow of the material in the mould. The mechanism of high frequency heating is briefly explained and practical arrangements are discussed. Physical and electrical properties of mouldings prepared by conventional and heatronic methods are compared, and notes are given on requirements of electrical equipment for high frequency heating. C.

**Rubber: Structure and Elasticity.** I. R. G. Treloar. *Reports on Progress in Physics*, 1942-43, 9, 113-136. Recent developments in the study of elastic molecules, the molecular structure of rubbers, crystallization, the transition to the glassy state, the application of the kinetic theory to a molecular network and various attempts to solve the network problem are reviewed, and an attempt is made to show how both the elastic and other states of a rubber are related to the properties of the molecule and the arrangement of the molecules in the material. C.

**Amino Nitrogen Determination Apparatus: Construction and Use.** D. G. Doherty and C. L. Ogg. *Ind. Eng. Chem. (Anal. Edn.)*, 1943, 15, 751-753. Details are given of an accessory reaction chamber for use with a standard manometric Van Slyke apparatus which permits the introduction of large samples of solid materials, removal of the gas evolved at stated intervals, and easy cleaning of the chamber at the end of the analysis. The calibrated Van Slyke extraction chamber is used only for measurement of the nitrogen evolved. The method of use is explained. Curves are given showing the rates of evolution of nitrogen from wool, silk, gelatin and other proteins and protein derivatives, and the values for the free amino nitrogen contents obtained by extrapolation and calculation are tabulated. C.

**Electrolytic Conductance Measurement Apparatus: Industrial Applications.** N. Schnoll. *Instruments*, 1943, 16, 730-731, 746. Apparatus for the measurement of the conductivity of electrolytes is briefly described and industrial applications, e.g. for control purposes in washing and rinsing processes and for the detection and estimation of impurities in distilled water, steam condensates, boiler water, etc., are discussed. C.

**Spectrochemical Analysis Apparatus: Description and Application.** E. K. Jaycox. *J. Applied Physics*, 1943, 14, 619-631. An account is given of modern spectrochemical apparatus, techniques of qualitative and quantitative spectrochemical analyses, and various practical applications. A method of determining the concentrations of dibutyl phthalate and triphenyl phosphate in a sample of cellulose acetate by a comparison of the absorption curves of the sample and the plasticizers is described. C.

**Cysteine and Cystine: Determination.** D. K. Mecham. *J. Biol. Chem.*, 1943, 151, 643-645. Details are given of modifications in Vassel's procedure which increase the precision of determinations of cysteine and of cysteine + cystine, particularly in the presence of detergents. The method depends on the development of a blue colour by reaction of cysteine with *p*-aminodimethylaniline, ferric iron, and zinc. Results obtained on hydrolysates of hair, feathers, and hoof are given. C.

**Formyl Group: Determination.** J. F. Alincino. *Ind. Eng. Chem. (Anal. Edn.)*, 1943, 15, 764. The formyl group can be determined under the same conditions as the acetyl group. The determination can be made specific by treating the distilled formic acid with an excess of bromine and determining the excess iodometrically. Results obtained in this way are compared with results obtained by the Elek-Harte procedure for acetyl groups. C.

***p*-Toluidine: Determination.** L. Koch. *J. Assoc. Offic. Agric. Chemists*, 1943, 26, 485-488. Details are given of a procedure for the determination of *p*-toluidine in the reduction products of D. & C. Green No. 5, 1:4-(*o*-sulpho-*p*-toluino)-anthraquinone, which comprises extracting the amine with ether, transferring it to dilute sulphuric acid adding K bromate and bromide solution, fol-

lowed by K iodide, and titrating the liberated iodine with sodium thiosulphate. C.

**Cellulose Trityl Ether: Preparation.** W. M. Hearon, G. D. Hiatt and C. R. Fordyce. *J. Amer. Chem. Soc.*, 1943, **65**, 2449-2452. A report is given of a detailed study of reaction conditions for the preparation of cellulose trityl (triphenylmethyl) ethers. Regenerated celluloses provide the most suitable starting materials. Products containing from approximately 1.0 to 1.2 trityl groups for each glucose unit may readily be obtained. By proper choice of reaction conditions, very little degradation of cellulose occurs during tritylation. Detritylation by treatment with acid may result in appreciable degradation of the cellulose. This may be largely avoided by use of a solution of hydrochloric acid in an organic solvent. The tritylation reaction has been shown to be 13.8 times as fast with primary as with the average of secondary hydroxyl groups. Under moderate reaction conditions tritylation may be carried out to cover approximately 90 per cent. of the available primary hydroxyl groups, with simultaneous reaction to a small degree with secondary hydroxyl groups. C.

**Polysaccharide Hydroxyl Groups: Investigation by Tosylation and Tritylation.** W. Low and E. V. White. *J. Amer. Chem. Soc.* 1943, **65**, 2430-2432. Two independent methods, one employing *p*-toluenesulphonyl chloride ("tosylation") and a second using triphenylchloromethane ("tritylation") have been employed successfully to confirm primary hydroxylation in arabo-galactan. Details of the procedures and results are given. It is suggested that both methods could be more generally applied in the study of polysaccharide hydroxylation. C.

**Western Canadian Wheat: Starch Content.** J. A. Anderson and W. J. Eva. *Canadian J. Research*, 1943, **21 C**, 323-331. Starch and protein contents of a large number of samples of different grades of Western Canadian wheat were determined. For Grades 1 and 3 Northern the resulting correlation coefficient was  $-0.918$  and the relation between the two constituents was expressed by the equation  $\text{starch} = 68.0 - 1.12 \times \text{protein} (\pm 0.76)$ . The data for No. 5 wheat were heterogeneous, and yielded correlation coefficients of the order of  $-0.7$  which were too low for prediction of starch from protein content. By means of the equation it is estimated that for the past 16 crops the average starch content of Western Canadian wheat has varied between 51.1 and 55.1 per cent., with a mean value of 52.7 per cent. (13.5 per cent. moisture basis). Maps are given showing the starch contents of wheat in different regions in the period 1927 to 1938, and in 1941 and 1942. C.

**Silk Fibroin: Methylation.** A. H. Gordon, A. J. P. Martin and R. L. M. Synge. *Biochem. J.*, 1943, **37**, 538-543. Repeated treatment of silk fibroin with dimethyl sulphate in the presence of excess cold aqueous caustic soda resulted in the *O*-methylation of nearly all its tyrosine residues and about half of its serine residues. The groups accessible to etherification in this way were also accessible to acetylation when the fibroin was treated with boiling acetic anhydride. These results demonstrate that the serine residues of silk fibroin fall into two distinct categories with respect to their reactivity with dimethyl sulphate and alkali in the cold. C.

**Borated Resins: Preparation and Uses.** E. P. Irany. *Ind. Eng. Chem.*, 1943, **35**, 1290-1292. Boric acid reacts readily with macromolecular substances, such as cellulose esters and ethers and partially hydrolysed polyvinyl esters and acetals, which contain a number of hydroxyl groups per molecule. The products formed are spatially linked, insoluble, infusible boric acid esters or ester-like association compounds. These compounds are hydrolysed by mere contact with water or alcohols and regenerate the original thermoplastic resin without change. When boric acid is added to a non-aqueous solution of polymer-homologues of varying molecular weights in amount insufficient for complete conversion, the longest and most susceptible molecules are precipitated, whilst the shorter ones remain in solution. By this means sharp fractionation according to molecular weight can be effected. The borated resins can be readily ground or crushed to any required fineness and provide a means of obtaining finely powdered thermoplastics. Films of borated resins may be used as temporary protective coatings. Additions of boric acid are advantageous in the preparation of moulding materials, hectograph masses, and films. C.

**Proteins: Cysteine, Cystine and Methionine Content.** W. C. Hess and M. N. Sullivan. *J. Biol. Chem.*, 1943, **151**, 635-642. A report is given of determinations of the cysteine, cystine and methionine contents and the total sulphur and sulphur distribution in a number of proteins. The cysteine, cystine and methionine content of the proteins accounts for practically all of the total sulphur of the unhydrolysed proteins in seven out of ten cases. In three proteins, calf globin, edestin, and squash seed globulin, the cysteine, cystine, and methionine account for, respectively, 85, 82 and 87 per cent. of the total sulphur of the unhydrolysed proteins. The sulphur-amino acids, however, account for all of the sulphur in the hydrolysates of the squash seed globulin. About 13 per cent. of the sulphur is lost during the hydrolysis of this globulin in a form not yet explained. As determined by direct titration of the unhydrolysed protein with iodine, the total SH found agrees with the cysteine determined in the acid hydrolysate of the same protein. This indicates that cysteine complexes are present in the native protein. C.

**Solid Adsorbents: Energies of Liquid Immersion and of Vapour Adsorption.** G. Jura and W. D. Harkins. *J. Chem. Phys.*, 1943, **11**, 561-562. It is pointed out that the heat of adsorption of a vapour upon the surface of a solid can in general be calculated more accurately from heats of immersion and condensation than by any direct or indirect experimental adsorption method. Equations showing the relationship between the energies of adsorption and immersion are deduced. C.

**Porous Materials: Surface Areas; Calculation from Capillary Radii.** E. N. Harvey, Jr. *J. Amer. Chem. Soc.*, 1943, **65**, 2343-2346. Equations are deduced that permit calculation of the surface areas of porous adsorbents from the high-pressure portion of adsorption isotherms. When the adsorbed layer is taken into consideration and when the desorption isotherm is used, pore radii usually give surface areas in good agreement with those obtained by the "Point B" method of Emmett and Brunauer. A tabulation of results by both methods is included for representative vapour-adsorbent systems. C.

**Globular Proteins: Conversion to Orientated Fibrous Proteins.** F. R. Senti, C. R. Eddy and G. C. Nutting. *J. Amer. Chem. Soc.*, 1943, **65**, 2473. Globular proteins have been converted to the fibrous form characterised by the diffraction pattern of  $\beta$ -keratin by heating the protein with water and extruding or stretching it in cold or hot water or water vapour. Among the proteins which have thus given  $\beta$ -keratin patterns, are casein,  $\beta$ -lactoglobulin, haemoglobin, ovalbumin, edestin, zein, and peanut and soybean proteins, the best patterns being obtained from  $\beta$ -lactoglobulin and ovalbumin. A high degree of double orientation has been achieved in an ovalbumin preparation. The tensile strength of casein, lactoglobulin, and ovalbumin filaments is greatly increased by conversion of the protein to the orientated fibrous form. C.

**Varnish Resins: Determination of Polymer Distribution.** H. E. Adams and P. O. Powers. *Ind. Eng. Chem. (Anal. Edn.)*, 1943, **15**, 711-714. An estimate of the distribution of polymers of different molecular weight in varnish resins may be made by precipitating the resin from dilute solution with measured amounts of a non-solvent and determining the decrease in light transmission through the medium. The titration curves obtained in this manner may be used to compare resins of the same type. In order to estimate polymer distribution from these curves, the concentrations of non-solvent at which carefully separated fractions of a resin are precipitated must be determined. Applications of the method to hydrocarbon resins, rosin-modified phenolic and maleic resins, and pure phenolic resins, using toluene as the solvent and methanol or hexane as non-solvent, are discussed. C.

**Emulsions: Mechanical Stability.** R. C. Merrill, Jr. *Ind. Eng. Chem. (Anal. Edn.)*, 1943, **15**, 743-746. A rapid method for determining the mechanical stability of emulsions involves measuring the rate of separation of internal phase under a constant centrifugal force. The reciprocal of the initial rate of separation at a constant centrifuge speed is taken as a quantitative index of the mechanical stability of the emulsion. The method has been applied to both water-in-oil and oil-in-water emulsions stabilized by lecithin, soaps and vegetable gums. It gives results in a few hours apparently comparable to those

obtained by more tedious methods involving other factors and requiring measurements over many months. Details are given of results obtained with aqueous emulsions of butyl phthalate. Definite decreases in mechanical stability with age were observed in the case of soap and saponin-stabilized emulsions. C.

**Pectin: Use as an Emulsifying Agent.** H. Lotzkar and W. D. Maclay. *Ind. Eng. Chem.*, 1943, **35**, 1294-1297. A report is given of a comparison of the stabilities of aqueous emulsions of olive, cottonseed and mineral oils stabilized with pectin and with gums tragacanth, karaya, and acacia under diverse conditions of acidity, ratio of oil to water, and concentration of emulsifying agent. Changes in the emulsions were followed by measuring the pH, viscosity, and specific interfacial area of the dispersed oil at regular intervals over a period of 10 weeks. Stability coefficients were calculated from the specific surface data. In general, the tragacanth-stabilized emulsions were coarse and viscous, the acacia emulsions fine and fluid, the karaya emulsions gelatinous, and the pectin emulsions fine and viscous. Viscosity and, in most cases, average particle size decreased with increasing acidity. There appeared to be no relation between initial viscosity and stability. The data indicate that there is little difference between pectin and tragacanth as emulsifying agents for olive oil. Both are more effective at the lower pH values. Pectin appears to be slightly better than tragacanth as an emulsifying agent for cottonseed oil. As an emulsifying agent for mineral oil, pectin is superior to tragacanth and acacia, and is at least equal to karaya. C.

**Plant Spray Coatings: Water Vapour Permeability.** C. I. Comar and E. J. Miller. *Ind. Eng. Chem. (Anal. Edn.)*, 1943, **15**, 737-740. In a method for the determination of the permeability to water vapour of films formed from wax and oil-spray emulsions of the oil-in-water type, the material is fastened over the mouth of a cup containing water in a desiccator, and the loss of moisture through the sample to the drier atmosphere is determined by weighing. The results of tests on oil and wax films on bond paper are discussed. Tables and graphs are given showing the effects on moisture impendence of film thickness, film weight, and oil content and the effects of additions of wax and of bentonite to the oil emulsions. A linear relationship was found between moisture impendence and film thickness. C.

**Titanium Dioxide: Moisture Sorption and Attractive Energy.** W. D. Harkins and G. Jura. *J. Chem. Phys.*, 1943, **11**, 560-561. Experimental studies of the extension of the attractive energy of a solid into an adjacent liquid or film are briefly described, and a curve is given showing the variation in the energy of emersion when water is adsorbed on a sample of titanium dioxide. The values for the excess heat of desorption (or adsorption) per mole for each molecular layer, above that for water itself, seem to suggest an exponential decay. C.

**Collodion Membranes: Swelling in Water and Electrolyte Solutions.** C. W. Carr and K. Sollner. *J. Gen. Physiol.*, 1943, **27**, 77-89. Changes in weight and volume of collodion membranes when placed in water and when transferred from water to solutions of strong electrolytes have been determined. The data show that dried collodion membranes swell reversibly to an appreciable extent when placed in water, the swelling varying from 5 to 11 per cent. depending on the brand of collodion. The water uptake and swelling of oxidised collodion are the same as those of the original unoxidised preparation. The water uptake, as determined by the weight increase, is larger than could be accounted for by the volume increase, swelling accounting for only 60 to 70 per cent. of the water taken up by the membranes. On transference from water to solutions of various strong electrolytes, there is no detectable change in volume of dried collodion membranes or of porous membranes. When dried collodion membranes swell in water, some of the water becomes bound water, and both intramolecular and intermolecular swelling seem to occur. Hence, neither the weight increase nor the volume increase nor their difference can be taken as a measure of the true pore space of the membrane. C.

**Leuco Dyes: Photochemical Reactions in Rigid Solvents.** G. N. Lewis and J. Bigeleisen. *J. Amer. Chem. Soc.*, 1943, **65**, 2419-2423. When oxazine and thiazine are illuminated in a rigid solvent, each gives two semiquinone forms. The first is produced simply by the ejection of an electron, the second grows



from the first on standing, by the loss of a proton. When the leuco bases of methylene blue, thionine and Capri blue are similarly illuminated, very complex spectrograms are obtained. By using different solvents and by observations of the changes on standing, it has been possible to analyse the spectra and show the presence of five different substances. Two of these are the semiquinone forms. One is identified with the completely oxidised ion of the dye. The remaining two are derived from the dimer of the leuco base, which is shown to be the main substance that is photo-oxidised. In this process, one photon produces double oxidation. Leuco crystal violet, leuco malachite green, and Michler's hydride behave similarly. The absorption maxima of their two semiquinone forms are given. Experiments with the base of Wurster's blue have shown that the quantum yield of Wurster's blue ions is 0.10 near the beginning of illumination. When leuco methylene blue is illuminated, the quantum yield of the methylene blue ions increases with the concentration of the leuco base and diminishes with increasing illumination. In concentrated solutions the initial quantum yield is about 0.04. From the effect of concentration and time of illumination, it is shown that a dimer of the leuco base exists and is responsible for most of the photochemical products. C.

**Chromatic Valence: Correlation with Munsell Chroma.** E. Q. Adams. *J. Optical Soc. America*, 1943, 33, 683. By applying the Munsell-Sloan-Godlove value function to all three tri-stimulus values  $X_c$ ,  $Y$ , and  $Z_c$ , and plotting the differences,  $V_X - V_Y$ ,  $V_Z - V_Y$ , with a scale factor of  $2\frac{1}{2}$ , radial distances from the illuminant point were found to be reasonably well correlated with Munsell chroma along any one hue radius, but equal differences in chroma corresponded to quite different distances, e.g. for the hue Y and PB, on the "chromatic value" diagram. This calculation assumed that the sensitivity of each of the three sets of retinal receptors is independently determined by the respective tri-stimulus value. If it be assumed that the sensitivity of all three sets depends on the same mean between the general and local value of Y, the functions  $[(X_c/Y) - 1]V_J$ ,  $[(Z_c/Y) - 1]V_J$ , result.  $V_J$  signifies that the Judd (quintic-parabola) value function has been used in the calculations. These functions, collectively called "chromatic valence," plotted with a scale factor of  $2\frac{1}{2}$ , give nearly equal radial distances for equal changes in Munsell chroma, e.g. for the hues Y and PB. Since the functions have the common factor  $V_J$ , their ratio  $(X_c - Y)/(Z_c - Y)$  is the same for all colours of the same dominant wave length. For colours of equal value the "chromatic valence" diagram is geometrically similar to the constant-brightness chromaticity diagram. C.

**Colour Harmony: Aesthetic Measure.** Domina E. Spencer. *J. Optical Soc. America*, 1943, 33, 683. In previous formulations of colour harmony there has been no attempt to specify which harmonies are good and which are poor. Certainly some of the recommended colour combinations are much better than others. The author considers a rating system for harmonies. The general subject of aesthetic measure gives a numerical designation to the aesthetic qualities of any form of art. The aesthetic measure is defined as the ratio of the elements of order to the elements of complexity. The constants used in evaluating these elements were determined by experiments on coloured designs. By use of these constants it is now possible to rate any design on the basis of elements of identity, similarity, contrast, ambiguity, complexity, and area balance. Examples are given showing how change in colour alters the aesthetic measure of a design. C.

**Colour Harmony: Formulation.** Parry Moon. *J. Optical Soc. America*, 1943, 33, 683. Numerous theories of colour harmony have been formulated but the results have not been satisfactory, partly because of difficulties with the specification of colour and partly because of the neglect of the relative areas of the colour patches. Before the advent of the C.I.E. system, scientific colour harmony was barely possible, and even the C.I.E. colour space cannot be used directly in colour harmony because equal perceptual steps are represented by quite unequal distances. The author develops a system of colour harmony based on the metric colour space considered in a previous paper. The theory makes use of ideas of harmony found by the artist, but states them quantitatively. The system is based on two ideas: (1) colours should be spaced so that ambiguities are eliminated; (2) the points representing these colours in  $\omega$ -space should be related in a simple geometric manner. On this foundation,



colour harmonies are classified, starting with the simplest two-colour achromatic harmonies and progressing to complicated harmonies in colour 3-space. The adjustment of area to obtain an æsthetic effect is considered. A number of examples are given to show the procedure in using the new system of colour harmony. C.

**Colour Harmony: Generalized Theory.** Domina E. Spencer. *J. Optical Soc. America*, 1943, 33, 683. In Moon's paper on the formulation of colour harmony a fixed state of adaptation is assumed. That is, the eye is assumed to be adapted in all cases to a neutral gray of Munsell value 5. But this is by no means the most general case. Adaptation may be to a chromatic surround or may be influenced by the design itself. The general case is treated in the present paper. The basis for the theory is the metric colour space previously developed and the composite stimulus. Postulates are formulated which define a harmony with any state of adaptation. The mathematical details of obtaining satisfactory harmonies for any given adaptation are worked out. The more difficult cases where adaptation is determined by the design itself are then treated. An interesting application of the method is to the theoretical investigation of the effect of the illuminant on the æsthetic value of a coloured design. C.

**Small Colour Differences: Graphical Representation.** D. L. MacAdam. *J. Optical Soc. America*, 1943, 33, 675-679. Wright's suggestion that some plane projective transformation of the I.C.I. chromaticity diagram may prove adequate as a uniform chromaticity chart is critically discussed and the conclusion is reached that projective transformations are fundamentally inadequate for uniform representation of the experimental facts. C.

**Spectral Colours: Subjective Boundaries.** D. Farnsworth. *J. Optical Soc. America*, 1943, 33, 682. Experiments were made with 400 colour-naïve observers of various ages, occupations, and educational backgrounds and a small number of colour-experienced observers. A projected spectrum was presented to the light-adapted eye. The surround was large, neutral and of moderate brightness, and effects of induced contrast were controlled by automatically timed rests. Instructions were to "set the needle between the colours so as to divide one colour from the next"; data consisted of readings on a calibrated scale of the positions at which the observers set the needle; instructions were given and settings were made without the use of colour names. Boundaries are presented for 3-, 4-, 5- and 6-colour divisions. There was excellent agreement on these boundaries among the judgments of the 400 naïve subjects but not among the judgments of the colour specialists, artists, psychologists, and other theory-indoctrinated observers. The means of the settings of the naïve observers are presented as divisions which would specify valid and generally acceptable spectral regions for use in commerce, science and education. C.

**Reflection and Transmission Measurements: Geometric Identification.** R. S. Hunter. *J. Optical Soc. America*, 1943, 33, 685. To identify any method for measuring reflection or transmission, its spectral and geometric characteristics must be given. By geometric characteristics are meant the directions in which light is allowed to strike specimens and the directions in which light reflected or transmitted by them is accepted for measurements. There are three types of reflection measurements which must be identified geometrically: (1) Reflectance (Total),  $R$ =total light reflected by specimen divided by that incident on it. (2) Fractional reflectance,  $R_f$ =light reflected by specimen in specified directions divided by that incident on it. (3) Directional reflectance,  $R_d$ =light reflected by specimen in specified directions divided by that which would be reflected in same directions by perfectly diffusing, completely reflecting specimen. The suggested terms, symbols and definitions for the three corresponding types of transmission measurements are identical except for the substitution of the words transmittance and transmitted, for reflectance and reflected, respectively, and for the use of the letter  $T$  instead of  $R$ . The directions of incidence must be included in descriptions of all three types of quantities and the directions of viewing in descriptions of the latter two. In some descriptions, it is necessary to give only the central directions, but where the powers of specimens to reflect or transmit light may change importantly within the directions involved, the solid-angle segments of directions must also be given. Unless an instrument is

free of vignetting, moreover, the weights given to incident and reflected light within the individual components of these segments must become a part of the complete geometric description. It is shown that devices to measure specular gloss should be identified by complete geometric descriptions and that some such devices heretofore considered geometrically identical may differ because of differences in spread or vignetting. It is also shown that if the receptor is small and uniformly sensitive, values for identical geometric conditions on the second and third scales above are related by the equation  $R_1 = \omega \cos \theta R_2 / \pi$ , where  $\omega$  is the solid angle of the receptor segment and  $\theta$  is the angle between the normal to the test specimen and the axis of this segment. C.

**Water Droplets; Scattering of Light by** — R. Ruedy. *Canadian J. Research*, 1943, 21 A, 99-109. When very small drops of water increase in size until their diameter is one-fourth of the wave length of the incident light ( $2a/\lambda = \frac{1}{4}$ ), they scatter the light essentially according to Rayleigh's law for non-conducting particles, but when the diameter increases from  $\lambda/4$  to  $\lambda/2$ , the intensity of light scattered along directions that point toward the source decreases almost to zero, the change being most marked between  $2a/\lambda = \frac{1}{4}$  and  $2a/\lambda = \frac{3}{8}$ . The sharp increase in the proportion of scattered light with an increase in size, according to the sixth power of the radius, continues, however, in the directions along which the main part of the scattered light is radiated by the particle. As the scattering begins to deviate from that given by Rayleigh's law, colours other than blue appear with great strength; the dispersion of the colours increases with increasing size of the particles until mainly red light remains. C.

**Wool: Ammonia Treatment.** A. Schöberl. *Biochem. Z.*, 1942, 313, 214-228 (through *Chem. Abs.*, 1943, 37, 5247). The importance of the formation of a thio-ether sulphur in lanthionine through the treatment of wool fibres with alkaline solutions, whereby the fibre structure is not much affected, is emphasised. It seems certain that the SS combination of the cystine residues in peptide linkage are hydrolysed to SH, the thio-ether combination occurring with the removal of hydrogen sulphide. Two equations are given which suggest an alternative path. Attention is called to the lability of the SS combination of cystine. W.

**Keratins: Dispersion by Reduction in Neutral Solutions of Protein Denaturants.** C. B. Jones and D. K. Mecham. *Archives of Biochemistry*, 1943, 3, 193-202. Keratins can be dispersed at neutral reaction by cleavage of their disulphide bonds, either by reduction with sulphydryl compounds or by the action of bisulphite, in the presence of any of a number of substances (urea, guanidine, a synthetic detergent, and others) which act upon non-keratin proteins as denaturants. The dispersibility of one keratin may differ from that of another in a particular combination of dispersing and disulphide-splitting agents and may vary with different combinations of these agents. Of the keratins investigated, feather keratin is most readily dispersed in neutral solutions, and ovokeratin is unique in its resistance to dispersion not only in neutral solutions but also in alkaline reducing solutions. W.

**Melting Point Curves of some Binary Wax Mixtures.** W. J. Ellis. *Australia: J. Council Sci. Ind. Res.*, 1943, 16, 179-184. Melting points were determined by attaching aluminium pellets to a brass plate by the wax mixtures and observing the temperature at which the pellets fell off when the plate was slowly heated under water. Melting point curves for all combinations of the following waxes are given: wool wax, beeswax, paraffin, esparto, gram (wax from a plant grown in New South Wales), hydrogenated oleo-stearine, sugarcane, shellac wax, paraffin synthetic, and carnauba. W.

**Keratin and Fibroin: Coloured Metallic Complexes.** B. Nilssen. 5 *Nordiske Kemikermøde*, 1939, 234-236 (through *Brit. Chem. Abs.*, 1944, A II, 28). The coloration given with nitrous acid and keratin or fibroin is due to conversion of tyrosine residues into *o*-quinonemonoxime residues which give lakes with heavy metals. W.

**Keratins: Long X-Ray Diffraction Spacings.** R. S. Bear. *J. Amer. Chem. Soc.*, 1943, 65, 1784-1785. Evidence has been obtained for fibre-axis periods of 198 and 95 Å for porcupine quill and feather keratin, respectively. Reasons are advanced for preferring the 198 Å spacing for porcupine quill to MacArthur's suggested 658 Å spacing (*these Abs.*, 1943, A 440). W.

## PATENTS

**Protein and Cellulosic Rags: Use for Preparing Foodstuff.** Sylvia M. Everett. B.P.558,889 of 22/5/1942:26/1/1944. Nutrients for micro-organisms and animals are made by mixing in the required proportions the products of an alkaline hydrolysis of a scleroprotein, particularly a keratin protein, wool, hair, silk, or shoddy, rags and the like, with the products of an acid hydrolysis of any scleroprotein, or of cellulose, a cellulose ester, or partially hydrolysed cellulose so as to convert the products into salts suitable to the metabolism of the organism or animal. To improve the metabolic value amino acids and/or vitamins may be added. C.

**Chlorine Dioxide: Production.** Mathieson Alkali Works. B.P.558,960 of 17/7/1942:28/1/1944 (Conv. 15/7/1941). Chlorine dioxide is produced by reacting a metal chlorate with a mineral acid of pH not much exceeding 1 in the presence of hydrogen peroxide at a temperature not much above 70° C. The proportion of hydrogen peroxide should preferably be approximately equivalent to that of the chlorate. To effect substantially complete conversion of the chlorate at 20-25° C., the chlorate should be supplied as a saturated solution and the water content of the reaction mixture kept at a minimum. At higher temperatures, e.g. 40-60° C., high conversions can be attained with less concentrated reactants. C.

**Thick-bodied Starch: Preparation.** American Maize Products Co. U.S.P. 2,328,537. A non-halogenated starch characterised by high resistance of the granules to rupture on cooking in water is obtained by treatment of a suspension of starch adjusted to pH 8-12 with a minor proportion of phosphorus oxychloride, phosphorus pentachloride, thiophosphoryl chloride, antimony pentachloride or antimony oxychloride, followed by washing and drying. C.

**Lignocellulose: Pulping and Hydrogenating.** E. C. Sherrard and E. E. Harris (assigned to United States Department of Agriculture). U.S.P.2,328,749. Lignocellulosic material is heated at 150-225° C. (3000-6000 lb. per sq. inch) with caustic soda solution (10-100 parts of NaOH per 200 parts of material) in the presence of a hydrogenating catalyst (molybdenum, tungsten or derivatives of Group VIII metals), and in an atmosphere of hydrogen. The lignin is reduced to products that pass into solution but the cellulose remains intact. C.

**Sulphonated Oils, Fats, Fatty Acids and Esters: Purification.** U.S.P. 2,328,931. The crude sulphonation mass is dispersed in at least an equal volume of a dry organic solvent and neutralised, the insoluble products are separated, and the solution is distilled to remove solvent and water. C.

## 10—ECONOMICS

**American Textiles: Production and Consumption Statistics, 1942.** *Rayon Organon*, 1943, 14, 15-28. Statistics are given for U.S. annual production of rayon filament yarn and rayon staple fibre in the period 1911-1942, and for the distribution of domestic rayon yarn deliveries by trades, quarterly domestic production of rayon yarn and staple fibre, distribution of rayon filament yarn production by denier, consumption or activity indices for cotton, silk, wool and rayon, monthly and annual imports of rayon filament yarn, staple fibre and waste, rayon filament yarn exports, spot cotton, wool, silk and rayon prices, monthly deliveries of raw silk to U.S. mills, U.S. monthly scoured wool consumption, and U.S. monthly lint cotton consumption in 1942 and preceding years. C.

**Rayon Industry: Post-war Development.** British Rayon Federation. *Textile Weekly*, 1944, 33, 203-204. A summary is given of interim comments on the Report of the Cotton Board Committee as it affects the rayon industry. A plea is entered for close co-operation between all those who convert cotton and rayon into yarns and fabrics, but the Rayon Federation would prefer to have a research organisation under its own control. C.

**Textile Wholesale Prices; January, 1944.** *Bd. Trade J.*, 1944, 150, 53. The wholesale price index numbers for January are Cotton 139.5, Wool 182.8, Other textiles 133.6, All articles 164.0 (1930=100). C.

**Colombian Textile Industries: Development.** C. J. de la Torre. *Rayon Textile Monthly*, 1943, 24, 657-659. A review of recent developments in the textile

industries of Colombia with statistics of raw cotton and yarn consumption and stocks, the cotton crop, machinery imports, rayon production (one firm) and yarn imports, and quantities of bast and related fibres produced. C.

**Textile Companies: Vertical Organization.** H. S. Davies. *Textile Research*, 1943, 13, No. 14, 30-35. A discussion of recent trends towards "vertical integration" in the American textile industries. Starting as a "converter" and a commercial dyer of rayon yarns, the Atlantic Rayon Corporation has now acquired Suncook Mills, a producer of rayon gray goods, and has formed a subsidiary known as Textron, Inc., to market women's slips. In addition to slips, Textron is also selling shower curtains, drapes, and piece goods to retail stores, and other merchandise will probably be added to the Textron line. In beginning with consumer products in which style and variety are unimportant or restricted to the fabric itself, the company is making use of one of the major principles of successful market-wise integration. It appears to be intended, however, to develop a vertical organization designed to market all or a substantial part of its cloth output as consumer goods direct to retailers. This is considered to be a highly risky undertaking. S. Robert Stone, Inc., converters of curtain goods, are expanding supply-wise by acquiring Fisher Manufacturing Co., weavers of fine cottons, including curtain materials. As the output of the latter is much less than the requirements of the former, the integrating company is virtually assured that it will never have an idle mill on its hands in times of slow business. The success of this arrangement, however, depends on the existence of an ample market in which to buy requirements in excess of the company's own production. Further, any company which tries to manufacture the product which it is buying must always take into account the fact that new techniques may outmode the material or process involved. C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Glass Wool and Thread: Manufacture; Skin Hazards.** L. Schwartz and I. Botvinick. *Indust. Med.*, Chicago, 1943, 12, No. 3, 142-144 (through *Bull. Hygiene*, 1943, 18, 1021). Glass wool, or slag wool, is made by driving high pressure steam upon streams of molten glass or slag, which is thereby pulled into fine fibres. The type of the resulting wool depends upon the composition of the glass used. Special chemical mixtures are required for glass textiles; here, the molten glass is passed through small apertures in the bottom of furnaces, from which it is drawn into fibres. The fibrous filaments are coated with a layer of liquid binder and wound on drums. This binder was blamed for the occurrence of 12 cases of dermatitis which appeared 2-8 weeks after first contact with the binder; a binder of different composition has been introduced. Glass wool is used as an insulator; as it is formed it is sprayed layer by layer with a binder or lubricant to hold the fibres together at the desired density. Phenol-formaldehyde resins are employed for these binders; no cases of dermatitis have been traced to them. The glass wool itself is a skin irritant. The workers quickly develop an immunity to its mechanical action, but the mechanical irritation may prepare the way for allergic dermatitis from the binder. Whilst the occurrence of dermatitis in this industry calls for watchfulness, the workers in the principal glass wool and textile departments report greater discomfort from gloves and protective clothing than from the material with which they work. C.

**Textile Foremen and Operatives: Training.** (1) W. E. Spain. (2) H. P. Galloway. *Cotton (U.S.)*, 1943, 107, No. 4, 79-82; No. 11, 79-82. The United States War Man-power Commission is promoting a system of apprentice training known as "Training Within Industry." This is in three parts, (1) Job Instructor Training, a quick method of teaching foremen how to train new workers, (2) Job Methods Training, which develops technical skill, and (3) Job Relations Training, which produces personnel officers. The first paper is by an official of the War Man-power Commission and gives advice on the training of job instructors. The other part summarises reports from several large mills about the benefits of the scheme. Thus, new operatives are in full work as weavers or spinners in less than half the usual period of training. C.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### LIST OF ABSTRACTORS

The Abstracts in this section of the "Journal" are supplied by the following Organisations, and the source indicated by the initials hereunder shown.

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In this Section the abstractors give digests of reports published in technical and scientific periodicals of the whole world. The opinions and claims expressed in the abstracts are those of the original authors and it must be understood that the staff of the Textile Institute do not necessarily endorse them.

### 1—FIBRES AND THEIR PRODUCTION

#### (C)—VEGETABLE

**Cotton Plant: Breeding.** A. Banfi. *Boletin Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 95, 153-163. The production of improved varieties of cotton by selection and by hybridization, and the possibilities and limitations of these methods, are discussed. Full details are given of the systems developed by the Texas Agricultural Experiment Station. The use of colchicine in cotton breeding is briefly discussed. C.

**Cotton Plant: Breeding.** R. G. Martins. *Bol. Minist. Agric., Rio de J.*, 1939, 28, 47-60 (through *Plant Breed. Abstr.*, 1944, 14, 60). The technique of artificial selection used in cotton breeding is described. Earliness, vigour, yield, and disease resistance are the characters on which field selection is based, boll size and weight, lint percentage, length and index, and seed weight being determined in the laboratory. Selection is always carried out in the locality for which the new varieties are designed. C.

**Cotton Plant: Breeding and Genetical Studies.** 54th Ann. Rept. South Carolina Exp. Sta., Clemson Agric. Coll., 1941, 182 pp. (through *Plant Breed. Abstr.*, 1944, 14, 23). Various physiological races of the same species of *Fusarium* have been shown to attack cotton, sweet potato and tobacco. Super 7 cotton has been selected for resistance to wilt, fibre length and fibre uniformity. Considerable work has been done with Sea Island varieties, but it has not been found possible to obtain satisfactory forms from hybrids between Sea Island cotton and Upland varieties, although breeding for this purpose has been in progress since 1935. Fibre characters, however, appear to be inherited independently of general plant characters and there appears to be some prospect of transferring the fibre characters of Sea Island strains to Upland cotton

by a process of hybridization and back-crossing. Strain Z10 of Seabrook is being selected for higher lint percentage and strain 12 B2 for longer staple. St. Vincent, a variety resistant to angular leaf-spot, has produced a line with larger bolls in Florida. Progeny of the following hybrids are being investigated: Seabrook × Andrews, Seabrook × Westberry, Seabrook × St. Vincent and Seabrook × Westberry) × (Puerto Rican × Bleak). Genetical studies have been made with the progeny of three crosses. Half and Half × King Blackseed has been studied for the inheritance of lint length and lint percentage, Tidewater × Rowden for staple length and lint percentage and Greenseed × Rowden for seed colour, staple length, lint percentage, seed weight, weight of seed cotton per plant, number of bolls per plant and weight of seed cotton per 100 bolls. C.

**Cotton Plants: Competition in Variety Tests.** T. R. Richmond. *J. Amer. Soc. Agron.*, 1943, 35, 606-612 (through *Plant Breed. Abstr.*, 1944, 14, 60). An appreciable degree of competition has been demonstrated between cotton varieties laid out in field tests. Generally speaking, the highest yielding varieties competed most strongly and plants growing in outside rows outyielded those of the same variety in inside rows. C.

**Cotton: Cultivation in Argentina.** R. García-Mata. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 96, 223-233. A short history of cotton cultivation in the Argentine Republic, dealing mainly with the period 1556 to 1926. C.

**Cotton: Cultivation in Spain.** *Textile Mercury & Argus*, 1944, 110, 289. Production of cotton in Spain reached 19,666 bales in 1942, but the capacity of the country is said to be six times this amount. There is an Institute for the Furthering of Textile Fibre Production and the Government Cotton Service is to promote the use of large tracts of land that will require irrigation. C.

**Long-staple Cotton: Production in Argentina.** Agrupación Algodonera de Fibra Larga. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 95, 147-152. A report is given of the work of the "Long Fibre Cotton Group," together with the text of the resolution by which this group was formed in January, 1942. Production of seed cotton by the members in the 1941-42 season amounted to 406,857 kg. in the province of Salta and 9,903 kg. in the province of Catamarca. Yields of fibre were 122,065 kg. and 3,332 kg., respectively, the ginning percentages being 28-31.9 per cent. in Salta and 32.3-35.5 per cent. in Catamarca. Details are given of the productions of individual members, and of grades and length. Varieties grown were Coker Wild (staple length 30-34 mm.), Coker's 100, Acala Blue Tag and Delta Pine 11A (28-29 mm.). The cotton was of good grade, yields were good, and high prices were obtained. C.

**Native Trinidad Cottons: Occurrence.** J. B. Hutchinson. *Tropical Agriculture*, 1943, 20, 235-238. Two species of cotton have been long established in Trinidad, namely, Marie-galante, *G. hirsutum* L. var. *marie-galante*, and free and kidney-seeded forms of *G. barbadense* and *G. barbadense* L. var. *braziliense*. Trinidad cottons are generally found in house-yards and counts have been made of the distribution and frequency of the two species in house-yards by the roadside on a route passing through orchard and cane belts. The total frequency of cottons in the orchard belt was only about 60 per cent. of that in the cane belt. Marie-galante occurred in 92 per cent. of the yards with cotton in the cane belt, and in only 44 per cent. in the orchard belt. Red-leaved types occurred in both species but were much commoner in Marie-galante than in *barbadense*. Two leaf shapes were observed in the Marie-galante population. Complete absence of cotton from all kinds of clearings other than house-yards, and from scrub land indicates that it is not indigenous in any part of the area sampled. Marie-galante cottons, however, are found on the comparatively dry western coasts and islands of Trinidad, and the possibility that they may be indigenous there cannot be ruled out. C.

**Wilt-resistant American Cotton Plants: Development.** (1) 54th Ann. Rept. Georgia Exp. Sta., 1941-42, 111 pp. (2) Bull. Georgia Coastal Plain Exp. Sta. (through *Plant Breed. Abstr.*, 1944, 14, 26). (1) Coker 100-wilt, a new variety derived from Cleve-wilt × Coker 100, combines earliness with wilt resistance. Varietal tests are reported, special attention being paid to wilt resistance. The strain 136-4-4 is being selected for such characters as lint yield and earliness.

(2) Tifton Station 21, an individual plant selection from Dixie Triumph, combines good yield and quality with wilt resistance and adaptability to conditions in South Georgia. C.

**Cotton Stem Weevil: Distribution and Seasonal History in South India.** P. N. K. Ayyar. *Indian J. Agric. Sci.*, 1943, 13, 255-263. A report is given of a survey of the distribution of the cotton stem weevil, *Pemphorus affinis* (Fst.), in four ecologically distinct tracts of South India. The probable factors affecting incidence are discussed. Evidence is accumulating that the weevil is indigenous in origin and that its original and natural food plant is probably not cotton. Its occurrence on other food plants in most districts is a source of potential danger to the spread of cotton cultivation. Data collected in a systematic examination of cotton plants in two fields during the period November, 1939, to August, 1940, and in the examination of various alternative food plants are tabulated and discussed. Observations of parasites of the stem weevil and their seasonal incidence are reported. C.

**Cotton Gin Cleaning System.** Junta Nacional del Algodón. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 95, 139-141. Improved patented arrangements for cleaning cotton during the ginning process are described. Compressed air is directed on to the teeth of the saws charged with cotton in a direction opposite to their direction of rotation and impurities separated from the cotton are withdrawn pneumatically. Details of construction are shown in diagrams. C.

**Cotton Plant: Experimental Work in Argentina, 1942.** *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 97-98, 266-319; No. 99-100, 371-404. (1) A detailed account is given of the work on cotton carried out in 1942 at the Experiment Station, Las Breñas, Chaco. This work included variety trials with twenty varieties of cotton, the breeding of improved strains of Farm Relief, Coker 100, Deltapine, Stoneville and other cottons by selection, the study of various hybrids, multiplication of Las Breñas, a selected strain of Coker 100, and studies of time of sowing, spacing of rows and plants, methods of cultivation, spraying with Frutone, and the occurrence and control of insect pests. (2) A report is given of climatic conditions in the 1941-42 season and of the work carried out at La Banda experiment station. The work included spacing and time of sowing experiments, comparative tests of 21 varieties of cotton, breeding by selection, multiplication of selected strains of Juntalgon Brebbia, Stoneville 5, Chaco, Carolina Foster, and Texacala cottons, and studies of methods of improving nitrous and alkaline soils. C.

**Cotton Stainer: Biology.** A. Freibert. *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 99-100, 360-370. An account is given of the biology of a species of cotton stainer, *Dysdercus* (Hemipterae Pyrrhocoridae), found in Argentina. C.

**Indian Cotton Crop, 1943-44: Controlled Prices.** *Indian Textile J.*, 1943, 54, 103. The minimum and maximum prices for various types of Indian cotton, fixed for 1943-44 by the Indian Government, are tabulated. Thus, the range for Indian Cotton Contract cotton (Jarilla,  $\frac{3}{8}$ -inch) is 400-550 rupees per candy (784 lb.) and for Cambodia and Punjab-American 289 F. cottons 610-760 rupees. The Government proposes to buy new crop (1943-44) cotton and sell it in relation to the interests of the growers and the condition of the markets. The basis on which purchase will be made is briefly explained. The Government does not desire to upset normal trading, but reserves the right to sell the cotton it purchases at any time when it is considered in the general interest to do so. C.

**Bast Fibres: Cottonization.** R. Haller. *Textilberichte*, 1943, 24, 6-8 (through *Chem. Abstr.*, 1943, 37, 6901<sup>9</sup>). The older processes of cottonization are reviewed; they have the disadvantage that they involve the use of caustic alkalis, together with hypochlorites, which are liable to lower the strength of the textile. A new method is described in which retted hemp is treated with caustic soda solution at 80-90°, then with K permanganate, washed and treated with sodium hypochlorite. The arrangement of the single cells in bast fibre can be made visible by dyeing with Ciba violet B and heating with water or glycerol above 100°. This method can be used to determine the effect of oxidising agents in cottonization operations. A large-scale application is described. C.



## (D)—ARTIFICIAL

**Soy Bean Protein Fibre: Production.** Drackett Co. (Cincinnati). *Rayon Textile Monthly*, 1944, 25, 37. It is announced that the Drackett Co. has started production of rayon staple from soybean protein. The company produces about 15,000 tons of soybean oil and 70,000 tons of meal annually. Roughly half of the meal is protein. Other products from soybean are plastics, wall-board and paints. C.

**Hemicelluloses: Removal from Wood; Action of Acids.** T. Ploetz. *Papier-Fabrikant*, 1943, 41, 17-18 (through *Chem. Abstr.*, 1943, 37, 6888<sup>g</sup>). The acids used were 0.36 per cent. hydrochloric (pH 1.07), 0.81 per cent. hydrobromic (pH 1.08), 1.69 per cent. oxalic (pH 1.16), 0.82 per cent. sulphuric (pH 1.04) and 4.8 per cent. phosphoric acid (pH 1.13). In each case 800 ml. of the acid was heated with 50 g. of extracted beechwood meal for 4 hours on a boiling-water bath; pentosan determinations were made on an aliquot portion after 1.5 hours and after 4 hours on the washed wood residues. The action of the acids was quite different; in general the greater the molecular volume of the acid, the slower was its action on the hemicelluloses. Hydrochloric acid had the most marked, and phosphoric acid the least action; hydrobromic acid is an exception and (apparently) has somewhat less action on the hemicelluloses than has oxalic acid, although its molecular volume is lower. This is ascribed to its specific action on the pentoses, which are converted very rapidly to furfuraldehyde. Whereas sulphuric and phosphoric acids have identical molecular volumes the latter is considerably less active than the former. This may be due to the lower mobility of the  $\text{H}_2\text{PO}_4^-$  ion. Sulphate pulps prepared from the beechwood residues in each case gave yields which fell into the same order as did the respective wood residues. Thus pre-hydrolysis with hydrochloric acid gave the lowest and phosphoric acid the highest pulp yield. C.

**Viscose: Filtration.** A. Marschall. *Kunstseide u. Zellwolle*, 1942, 24, 188-199 (through *Chem. Abstr.*, 1943, 37, 6889<sup>g</sup>). The filtration value (FV) was determined in a special laboratory pressure filter according to the equation  $FV = 200,000 (T_2/V_2 - T_1/V_1) / (T_2 - T_1)$ , in which  $T$  denotes time and  $V$  volume of filtrate. By increasing the concentration of caustic soda in the steeping liquor from 180 to 217 g. per l. for a beech pulp, FV dropped from 5,000 to 365 without altering the viscosity. Increase in temperature from 10° to 20° improved filtering from FV 150 to 70. A standard viscose solution giving an FV below 110 was considered satisfactory, whereas an FV over 120 was unsatisfactory. Improvement in filterability was related directly to the degree of defibration of alkali-cellulose. The presence of hemicellulose in solution adversely affected filterability; increasing the carbon disulphide concentration during xanthation had a favourable effect. By use of the standard filter apparatus, considerable differences were found with various cloths and fibre combinations. Filterability of a pulp is probably independent of any chemical differences, although ash constituents (mainly calcium salts) affect it adversely. Addition of 0.01 g. diatomaceous earth per l. of viscose solution effected a 30-100 per cent. increase in FV. Filterability is affected by small differences in the physical and colloid-chemical structure of cellulose. C.

**Ethylcellulose Filaments: Spinning.** H. Staudinger, H. Stock and K. F. Daemisch. *Textilberichte*, 1941, 22, 620-621 (through *Chem. Zentr.*, 1942, ii, 759 and *Chem. Abstr.*, 1943, 37, 6889<sup>g</sup>). The thermal decomposition of ethylcellulose begins at temperatures above 200° and is quite rapid at 250°, the degree of polymerization (DP) falling from 450 to 120 in 10 min. The strength of filaments cast from a melt at 250° is so low as to be commercially valueless. It is greater, however, than that of similarly treated native cellulose. The strength of cellulose fibres depends not only on the DP but also on the orientation. To minimize thermal degradation, previously prepared filaments of ethylcellulose were heated to 250° and stretched. The strength increased, the elongation decreased and the crease resistance remained almost unchanged. The strength of fibres from molten ethylcellulose is similar to that of rayons made from degraded cellulose. C.

**Nylon and Analogous Products: Synthesis.** R. Oda, W. Mokudai, M. Isihara and T. Morisita. *Bull. Inst. Phys. Chem. Res. (Tokyo)*, 1940, 19, 1448-1465, 1466-1471 (through *Sci. Papers Inst. Phys. Chem. Res. (Tokyo)*,



38, No. 1001-1003, *Chem. Zentr.*, 1941, i, 3169 and *Chem. Abstr.*, 1943, 37, 6900<sup>8</sup>). (1) Nylon, a high-molecular polyamide, is obtained by condensation of adipic acid with hexamethylenediamine. The adipic acid was prepared from cyclohexanone by oxidation with nitric acid. Hexamethylenediamine was prepared from adipic acid. The fused adipic acid was converted into the adipamide by treating with dry ammonia at 200°. The product was dehydrated with phosphorus pentachloride and reduced with sodium and alcohol. Pimelic acid, sebacic acid, suberic acid, ethylenediamine, tetramethylenediamine and octamethylenediamine were synthesized. Compounds which could be spun and which were extensible in the cold could be obtained in many cases by condensation of these products. The synthetic nylon fibre was identical with American nylon. (2) By the interaction of carbon disulphide and hexamethylenediamine in alcoholic solution a white powder was obtained which was shown to be 6-amino-*n*-hexyldithiocarbamic acid. When this product was heated for 30 min. in a current of nitrogen at 200° hydrogen sulphide was split off and a polythiourea was obtained which could be spun into long fibres. The mixed condensate of adipic acid, carbon disulphide and hexamethylenediamine was shown to be superior to nylon in many respects. C.

#### PATENTS

**Polyamide Compositions: Treatment to Improve Durability and Stiffness.** E. I. Du Pont de Nemours & Co. B.P.559,676 of 2/7/1941:1/3/1944 (Conv. 2/7/1940). Filaments, bristles, films, coatings and like structures comprising synthetic linear polyamides are improved by treatment with a substance containing at least one group having the formula  $-N:C:X$ , wherein X is oxygen or sulphur, e.g. an isocyanate. The polyamide may be immersed in the undiluted agent at 140-180° C., or may be immersed in a dilute solution of the agent, preferably at 80-110° C., removed and baked at 180-220° C. When improvement in durability is the main object it is preferred to use polyamides that contain absorbed moisture. When improvement in stiffness and moisture absorption alone is desired, it is preferred to use substantially anhydrous polyamides. The diisocyanates, e.g. hexamethylene diisocyanate, confer heat stability, increase stiffness, and lessen water absorption. The monoisocyanates are particularly useful only with respect to improving stiffness and lessening water absorption. C.

**Soy-bean Protein Spinning Solution.** Ford Motor Co. Ltd. B.P.559,745 of 10/7/1942:3/3/1944. A solution suitable for the spinning of artificial fibres is prepared by adding to an aqueous solution of a protein, e.g. soy protein, containing an alkali metal hydroxide, a xanthate which has been formed by the reaction of an alkali metal hydroxide, an alcohol and carbon disulphide, and has been aged. A suitable xanthate is formed by reaction of caustic soda, ethyl alcohol and carbon disulphide. Soft, pliant and strong fibres resembling wool can be obtained by spinning such solution into acid precipitating baths and treating in suitable salt baths. C.

**Cellulose Ether Filaments, Foils and Coatings: Production.** H. Dreyfus. B.P.559,754 of 28/8/1942:3/3/1944. Coagulating media for alkaline solutions of cellulose ethers comprise aqueous solutions of lower fatty acids containing metal salts of the acids, e.g. a solution of acetic acid and sodium acetate. The coagulating media may be employed in the production of filaments; foils and similar shaped articles by extruding aqueous alkaline solutions of the ethers through suitable shaping devices or they may be employed for the coagulation of cellulose ether solutions in or upon fabrics or other articles. C.

**Cellulose Esters: Production.** Celanese Corporation of America. U.S.P. 2,329,704, 2,329,705, 2,329,706, 2,329,717, 2,329,718, 2,329,730. Cellulose is esterified with a lower fatty acid anhydride in the presence of sulphuric or phosphoric acid, the catalyst is neutralized by the addition of a Ca, Mg, Zn or Al compound, water is added and ripening is allowed to proceed in stages. The various claims are based on variations in the extent of neutralization and the number of additions of water to establish the separate stages of ripening. C.

**Delinting Machine Suction Flue.** J. B. Ricker (Memphis, U.S.A.). U.S.P. 2,331,423. A delinting machine employing a bank of saws has a suction flue leading away from the saws, so designed and fitted with baffles that downward flow of air into the flue is prevented. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Scutcher with Pneumatically Cleared Toothed Beater: Development.** F. Wooding. *Textile Weekly*, 1944, 33, 442-446. A brief account is given of some experiments on the modification of the scutcher according to the Shirley Institute principle of cleaning by stream-lined air currents. An old Kirchner beater was converted into a wooden cylinder and covered with toothed wire at an angle of about  $45^\circ$ . By forming the cover casing into an "expansion chamber" following the point where the angle of the teeth was in the stream line of the air current passing under the beater on its way to the gathering cages it became possible to strip the wire at low or high beater speeds, when the intake current of air was suitably controlled. A pair of mote knives from a carding engine provided effective means of trash extraction, after modifying the edges. An air deflector was fitted under the beater to prevent nep from returning into the air stream and a sheet metal trap was introduced into the dirt box. It is considered that the new system might supersede the bladed beater and be adjusted to give great precision in opening and cleaning. C.

### (B)—SPINNING AND DOUBLING

**Mules: Stopping and Starting.** *Textile Weekly*, 1944, 33, 369-372. Practical hints are given on various devices for stopping and starting mules without great physical effort. C.

**Ring Spinning Efficiency: Calculation.** I. S. Nigam. *Indian Textile J.*, 1943, 54, 122. Methods of calculating the efficiency of ring spinning in a cotton mill are explained and illustrated by application to a particular case. C.

**Mule Spinning Mill: Staffing and Wage Payment.** *Textile Weekly*, 1944, 33, 477-481. The writer proposes to divide mule spinning rooms into sections of, say, 8 pairs of mules, or 18,000 spindles and to assign to each section (1) one adult operative per 1,000 spindles, (2) junior and women workers at the rate of one per 3,500 spindles, (3) extra labour, for coarse counts, in accordance with present agreements. Each section would be placed under a working spinner charge-hand, selected for his ability and promoted on merit. A scale of time-rate wages is suggested, with a peak at 24 years of age for men or 21 years for women, and production bonuses would be added. Examples are worked out. C.

### PATENTS

**Nylon Yarns: Twist-setting.** Imperial Chemical Industries Ltd. B.P. 559,369 of 29/7/1942:16/2/1944. A process for twist-setting a nylon yarn to reduce its twist liveliness without imparting objectionable yarn-setting, comprises treating the yarn at  $135-190^\circ\text{F}$ . and R.H. above 50 per cent. under sufficiently low tension to permit shrinking. C.

**Yarn Holder Painting Machine.** D. A. Jolley and J. P. Scarborough. U.S.P. 2,330,494. The claim is for a machine in which a yarn holder can be mounted for rotation against a marking element, including a paint brush, that can be swung into position by cam means and rotated, and is fed by the colouring material from a can. C.

**Spinning Apparatus.** V. Aldaba (Manila; vested in U.S. Alien Property Custodian). U.S.P. 2,330,537. The apparatus consists of positively driven means that drive by friction two reels mounted for radial movement with respect to the axis of rotation of the positive drive, a traverse rod reciprocated from one of the reels, a follower eyelet on the rod for the passage of spun yarn to one of the reels, and a roll on which is wound a cord that passes through a second follower eyelet on the rod and is connected to the other reel. C.

**Spinning Cap.** American Viscose Co. U.S.P. 2,331,200. The cap has a rim portion and carries an annular member of larger diameter that can be moved by means inside the cap from an inoperative position to a position adjacent the rim portion. C.

**Bobbin and Spindle.** Saco-Lowell Shops. U.S.P. 2,331,611. The claim is for an upright spindle with tapered tip that fits into a tapered bore of the bobbin with sufficient grip for driving. Elsewhere, there is a limited clearance between the spindle and the bore of the bobbin. C.

## 3—CONVERSION OF YARNS INTO FABRICS

## (A)—PREPARATORY PROCESSES

**Beam Warping Machine: Operation.** *Indian Textile J.*, 1943, 54, 110-112. A sketch showing the various parts of an ordinary beam warper and diagrams of the Singleton stop motion and various types of measuring motion for use on this machine are given. The methods of operation are explained. Precautions that should be taken in the warping process are outlined and some advantages of high speed warping are pointed out. C.

**Combination Rayon Fabric Weft: Throwing and Weaving.** A. C. Wayman. *Textile World*, 1943, 93, No. 4, 94-95. Illustrations are given of some weft defects in combination fabrics that can be traced to the doubling and twisting, e.g. looped picks due to the wrong balance of tension between the crêpe and the acetate ends. Defects due to bad shuttles and reeds are also mentioned and remedies are suggested. C.

## (C)—WEAVING

**Aeronautical Fabrics: Production.** Blackburn and District Managers' Mutual Association. *Textile Weekly*, 1944, 33, 364-366. A report of a practical discussion on warp preparation, sizing and weaving. C.

**Loom Picking Bands: Selection.** *Textile Weekly*, 1944, 33, 394, 396. Practical hints are given on the recognition of good oxhide for picking bands, the case for hairy bands, and proper storage. C.

**Automatic Canvas and Duck Cloth Loom.** John Williamson. *Textile Mercury & Argus*, 1944, 110, 351-353. A brief description is given of the various parts of a new Hattersley automatic shuttle-changing loom for canvas and duck cloths. C.

**Dobby Loom Heald Shafts: Correction of Wrong Lifting.** John Williamson. *Textile Mercury & Argus*, 1944, 110, 295, 296, 299. Practical notes are given on the causes that lead to a shaft being down when it should be up, or *vice versa*, with hints on the correction of wrong lifting. C.

**Weaving Shed Supply System.** W. A. Newell. *Textile World*, 1943, 93, No. 4, 80-81. Particulars are given of a system of storage bins and card index for dealing with loom parts and accessories. C.

**Woodside Cotton Mills (U.S.A.) Cloth Room: Organisation.** T. O. Ott. *Textile World*, 1943, 93, No. 4, 82-83. An illustrated account is given of the lay-out of a new cloth room in a S. Carolina mill. The machines are connected by chutes and guide rollers so that the cloth makes a straight passage with minimum handling. The sequence of machines is (1) a sewing machine, (2) a tandem brusher and shear, controlled by the woman at the sewing machine, and driven at 96 yards per minute, (3) a folding machine running intermittently at 126 yards per minute, worked by a man who keeps three women inspectors supplied with bundles at a long table arranged at right angles to the preceding line of machines, (4) two endless belts to convey the inspected cloth to trolleys on which they are correctly sorted by men who take the loads to (5) the baling press. The inspectors grade the cloth and do the necessary "spotting." "Seconds" are dealt with again on another inspection table and the weaver responsible is brought there to see the bad cloth. C.

**Vinyon Yarns: Weaving.** *Textile Weekly*, 1944, 33, 483-485. The qualities of Vinyon yarns and fabrics are listed and hints are given on suitable healds, temples, take-up rollers and shed timing for weaving light and heavy cloths. Vinyon is being offered as fine as 8 denier and in cabled yarns the equivalent of 5s cotton. A typical Vinyon canvas has 56 ends per inch of two-ply yarn cabled three-ply, equivalent to 12s cotton, and 31 picks per inch of 5-ply weft, equivalent to 5s cotton. C.

## (D)—KNITTING

**American Hosiery: Control of Production.** United States War Production Board. *Rayon Textile Monthly*, 1944, 25, 43-46. Order L-274 (amended 4/12/1943) for the control of production of hosiery is reproduced and supplemented by tables of knitting particulars for the permitted lines in (1) women's full-fashioned rayon hosiery, (2) ditto, cotton, (3) women's seamless, circular-

knit hosiery in rayon or cotton, (4) anklets, (5) boy's golf hosiery, and (6)-(10) children's and infants' hosiery. C.

**High-tenacity Rayon Yarn: Application in Hosiery.** *Rayon Textile Monthly*, 1944, 25, 33-35. The question is raised whether cellulosic rayons will have much of a prospect in the hosiery industry when silk and nylon become available again and a strong case is made out for the new high-tenacity yarns produced by the American Viscose Corporation (50 denier), the Du Pont Co. ("Cordura"), the Celanese Corporation of America ("Fortisan," 20 den., 160 filaments) and the Tubize-Chatillon Corporation ("Hygram," 75 den., 20 filaments). C.

**American Service Knitted Goods: Construction.** *Textile World*, 1943, 93, No. 4, 102-103. Brief descriptions are given of (1) cushion-sole or jungle socks and (2) mosquito gloves with long knitted cuffs, and particulars are tabulated of the yarns, machine diameters and needles required to meet specifications for 18 different types of Army socks. C.

**Hosiery and Knitted Underwear: Production in the United States.** *Textile World*, 1943, 93, No. 4, 98-99. A general review of the United States knitting industry under war conditions. Recent output figures are, in thousands of dozens (garments or pairs):—

	1939	1941	1942
Cotton and/or wool underwear ...	27,788	33,972	36,999
Rayon underwear ...	11,744	11,995	11,737
Hosiery ...	140,681	149,968	147,902

In 1942, the production of underwear for Government was 26 per cent. of the total. C.

#### (G)—FABRICS

**Casement Fabric: Costing.** H. M. Broadley. *Textile Weekly*, 1944, 33, 356, 374. The yarn processing and weaving costs are worked out for a casement fabric on the basis of the Statutory Price Control. C.

**American Army Cotton Twill: Construction and Processing.** *Textile World*, 1943, 93, No. 4, 88-89. An abstract is given of the U.S. Army Specification governing 8.2 oz. cotton twill for uniforms, and suitable details of processing from the blowroom to the finished cloth are suggested. C.

#### PATENTS

**Electrically-heated Composite Fabric: Production.** A. L. Mond. B.P. 559,322 of 13/11/1942:14/2/1944. An electrically-heated composite fabric comprises two or more layers or plies of uncut pile fabric joined together by means of a thermoplastic or thermosetting adhesive and having an electric heating resistance interposed between the layers or plies. The two layers may be coated with adhesive, placed in contact, and subjected to heat and pressure. A thermoplastic cut-out may be provided in the assembly for the purpose of cutting out the supply of current when the temperature of the assembly reaches scalding point and the leads to this cut out may be insulated with glass fabric. The term "uncut pile fabric" denotes a fabric comprising two woven outer layers between which is interposed a layer of pile integral with each of the woven outer layers. C.

**Loom Reed Supporting Arrangements.** J. Nelson Ltd. and R. T. Hartley. B.P. 559,430 of 18/8/1942:18/2/1944. The seatings in the reed cap and base of the sley are so constructed that direct contact is made between the ribs or baulks and the corresponding seatings only at or towards the bottom of the reed cap and the top of the sley base, the dents not making contact with the running or race board or with the reed cap, and no direct pressure being exerted on the reed dents in an end direction which would tend to cause them to buckle. The seatings in the reed cap and sley which receive the ribs or baulks are made V- or wedge-shaped so that when the reed cap is adjusted towards the sley base the reed will be held rigid. C.

**Straight-bar Knitting Machine Welt Turning Mechanism.** G. Blackburn & Sons Ltd. and H. W. and E. Start. B.P. 559,434 of 17/9/1942:18/2/1944. In a straight-bar knitting machine, a set of substantially vertical transfer points are provided and operated so as to engage with the loops held by the welt hooks when a pre-determined number of courses have been knitted to form the welt,

disengage the loops from the welt hooks, and restore them to the needles to complete the formation of the welt. When the welt hooks are disposed in a plane at right angles to the needles the stems of the welt hooks may be specially shaped to assist in the removal of the loops therefrom by the points. C.

**Knitting Machine Stop Motion.** Hemphill Co. (U.S.A.) and W. C. Lee. B.P. 559,435 of 18/9/1942:18/2/1944 (Conv. 10/9/1941). A knitting machine has a driving belt, a belt shifter for moving the belt to and from driving and loose pulleys, means for feeding wrap threads to selected needles, and a stop motion device having a movable element engageable by a part of the wrap-thread feeding means, and operably connected to the belt shifter to stop the machine whenever a wrap-thread breaks or becomes excessively slack. C.

**Knitting Machine Yarn Feeding Arrangements.** Bentley Engineering Co. Ltd., E. Brooksby and F. E. Deans. B.P. 559,533 of 20/7/1942:23/2/1944. A method of supplying a feed yarn to a needle hook consists in laying the yarn on to the front or nose of the hook and thereafter relatively adjusting the hook and the yarn to slide the latter into the hook. When the method is applied to a latch needle, the latch, when closed, may be conveniently made so as to project slightly beyond the hook and, should the latch be closed by a loop held by the needle when adjustment is made to slide the yarn into the hook, the yarn will ease the latch open sufficiently during that adjustment so as to pass between the latch and the hook. The invention is equally applicable in circumstances in which, in the case of a latch needle, the latch is not closed by a previously formed loop. By the use of this method of feeding yarn to the needles it is no longer necessary to hold open the latches in order to lay the yarn into the needle hooks, and the usual elaborate system of latch guarding devices is therefore dispensed with. A knitting needle designed to facilitate the improved method of feeding the yarn has a down-turned nose portion of the hook so shaped and sufficiently long as to enable the feed yarn to be received upon it above the latch, and a latch having its free end projecting outwardly beyond the front or nose of the hook to a sufficient extent to catch the feed yarn when the latter is slid down the front of the hook. C.

**Knitting Machine Loop Transfer System.** Bentley Engineering Co. Ltd., E. Brooksby and F. E. Deans. B.P. 559,543/4 of 20/7/1942:23/2/1944. (1) A transfer instrument for a knitting machine of the type having independently movable latch needles comprises a body part received within the needle trick and near its end a sheath which embraces the needle, is movable at will to enter a stitch, and is so shaped as to expand and hold the stitch so that it can be cleared from one needle, whereafter another needle can be entered into the sheath and the stitch held thereby. The transfer instrument may be designed so as to lie behind the needle so that the sheath will embrace the needle from behind. Conveniently, such a stitch transfer instrument is combined with a needle cylinder and, at one end of the cylinder, an annular cam surface with which the sheath portions of the transfer instruments are engaged as they are moved to the stitch transferring positions and by which the sheaths are moved forwardly into a position to embrace the needles. (2) In a loop transferring operation, the movement of the out-going needle is initiated by engagement with and movement of an incoming needle. Needles that are to receive the loops from the transferring instruments are selected from those in the out-of-action track and during an early part of their movement to the knitting track these needles engage head to head with the needles in the knitting track in the opposite bed and push them out of the knitting track to a position where they can be engaged by cams which take them to the out-of-action track. C.

**Circular Knitting Machine Patterning Mechanism.** H. H. Holmes, J. C. H. Hurd and Wildt & Co. Ltd. B.P. 559,712 of 27/7/1942:2/3/1944. A circular knitting machine is provided with two or more different kinds of instruments interspersed in the grooved bed and having associated therewith (a) primary selecting butts so arranged as to provide series of such butts respectively in different planes, but with the butts of one kind of instruments in the same planes as the butts of the other kind or kinds of instruments, and (b) auxiliary or secondary butts adapted to function as operating butts and for co-operation with means to effect a separation of the selected instruments of one kind from the selected instruments of the other kind or kinds. The instruments to be selected may be pelerine instruments, wrap or lap thread guides, reverse plating

instruments, points or transfer elements, or similar parts. They may be mounted in radial tricks formed in a dial. Cams or equivalent means are provided for acting on the butts. C.

**Gauze Loom Shedding Mechanism.** M. Banyai, E. Harris and A. Goldberg. B.P.559,744 of 4/6/1943: 3/3/1944. In a warp-shedding mechanism for looms for weaving semi-gauze and like fabrics of the type consisting of an assembly of discs or like members arranged in closely spaced relation in a row for joint angular movement about a common axis, each disc or like member is provided with one eye and with an elongated slot, and a warp is led through the eye and another warp is led through the slot so that, when the disc assembly is partially rotated through an angle of something less than  $180^\circ$ , the warps passing through the eyes are raised and lowered to form a shed for passage of a weft-carrying shuttle, and the warps passing through the slots merely slide from end to end of the slots. C.

**Double Pile Fabric: Weaving.** J. L. Baker (Langhorne Manor, Pa.). U.S.P. 2,329,738/9. The claims are for methods of weaving (1) a repeat of a double pile fabric the two components of which comprise two fabrics connected by common pile warp threads, and (2) pile fabrics, in which four sets of binder warp threads, two sets of stuffer warp threads, and pile warp threads are manipulated to form (1) upper and lower warp sheds, and (2) four sheds, and weft is supplied in double picks from yarn supplies at opposite sides of the loom. C.

**Fire Hose Jacket: Construction.** C. K. Huthsing (Grosse Pointe, Mich.). U.S.P.2,329,836. The jacket for a hose pipe is formed of annular strands interwoven with longitudinal strands that are spaced farther apart in limited regions at opposite sides of the hose than they are in the remaining fabric. C.

**Knitting Machine Stop Motion.** E. J. Ziock (Oakland, California). U.S.P. 2,329,971. The feed yarn normally supports a lever that in falling sets in motion a cutter to sever the yarn and friction means to hold the portion of severed yarn before the knitting elements under normal feeding tension. C.

**Weft-replenishing Loom Thread Cutter and Clamp.** Crompton & Knowles Loom Works. U.S.P.2,329,999. The claim is for a clamp for the thread cutting mechanism of a weft-replenishing loom, which is designed to produce a bend in the thread extending from the movable unit of the cutter and between the two faces (stationary and movable) of the clamp. C.

**Running Yarn Electrical Stop Motion.** Van Raalte Co. U.S.P.2,330,212. Means for stopping a textile machine when a running thread fails, comprise an electric circuit having a pair of spaced electrodes close to the path of the thread, and means for applying a conducting liquid to the thread between the electrodes. If the thread fails it closes the circuit across the electrodes and sets in operation means to stop the machine. C.

**Circular Knitting Machine Wrap Yarn Feeding Device.** R. H. Coleman, O. D. Hunt, E. E. Whisnant and C. L. Whisnant. U.S.P.2,330,269. Packages of wrap yarn are carried on a rotating head supported near the needles on an axis at right angles to the needle cylinder. There are two guide eyes for individual wrap yarns and means for determining the knitting of one of the yarns only by an intermediate needle of a selected group and the other yarn only by the outer needles of this group. C.

**Flat Straight-selvedged Fabric: Knitting.** Davenport-Woosley Processing Corporation. U.S.P.2,330,445. The claim is for a flat straight-selvedged fabric in which all the courses are reinforced by interknitting of two yarns except at end loops in alternate courses. These end loops are formed from one of the yarns only. C.

**Whip-roll Controlled Let-off Motion.** Crompton & Knowles Loom Works. U.S.P.2,330,514. An escapement mechanism is connected to the warp beam which, when unlocked, permits the warp to turn the beam. This movement is opposed by a brake which is released when a weight connected to the whip roll rises to a pre-determined point. C.

**Loom Picker Checking Device.** Crompton & Knowles Loom Works. U.S.P. 2,330,519. The device includes a stationary base member and a second member normally out of contact with the picker stop arm but moved by it when

the shaft rocks on a picking movement. One member slides within the other, hollow member, and they are held in their normal relation to each other by a body of soft elastic material located in the hollow member. C.

**Bulky Cloth: Production.** F. B. Voegeli and W. H. Baunon (Mansfield, Mass.). U.S.P. 2,330,645. A number of open-weave plies are woven from light cotton warp and weft of normal twist, the plies having common selvages and being interwoven only at spaced intervals, and the cloth is wetted in the free state so as to cause the yarns to loop out of the planes of the respective plies and contract the cloth, which is dried without tension and then stentered to full gray dimensions. The result is an elastic cloth having a large bulk per unit weight. C.

**Flat Hosiery Blanks: Knitting.** Real Silk Hosiery Mills Inc. U.S.P. 2,330,681, 2,330,683. The claims are for (1) the narrowing mechanism of a flat frame and (2) a hosiery blank with a wider portion between the foot and leg portions composed of a multiplicity of courses defining the parallel sides of a transverse rectangular area and narrowing to trapezoidal areas on either side. C.

**Skein Winding and Packaging Machine.** American Thread Co. U.S.P. 2,331,004. A "flier" comprising a thread guide on a carrier is traversed in figure-8 form by two members that rotate in opposite directions, each member having a peripheral recess for the carrier so located as to arrive at a position of alignment as they reach a pre-determined point in their rotation where the carrier changes from one recess to the other. C.

**Running Thread Dressing Device.** American Viscose Corporation. U.S.P. 2,331,207. Apparatus for applying liquid to a running yarn consists of a pair of toothed and grooved rollers, the bottom one rotating in the bath of liquid. C.

**Knitted and Woven Pile Fabric: Production.** Vanity Fair Mills, Inc. U.S.P. 2,331,289, 2,331,290. The claims are for a fabric and the method of making it, in which parallel rows of loops are knitted through a woven fabric, the loops are cross-connected by thread, and pile-loop threads are placed between the rows of knitted loops and under the cross-connecting thread and looped between adjacent cross-connecting threads to form pile loops. C.

**Thread Unwinding Apparatus.** Tubize Chatillon Corporation. U.S.P. 2,331,454. The bobbin of yarn is mounted on a shaft that slides freely between guides and is supported for rotation on an endless driving belt that is driven by at least one of two rollers over which it passes. C.

**Flat Knitting Machine.** Dexdale Hosiery Mills. U.S.P. 2,331,528. The claim is for mechanism for actuating the beard points so as to interpose them from above between the presser ledge and the hook needles and cause them to co-operate with the needles during the loop-forming cycles. C.

**Cellulose Acetate Rayon Anti-static Dressing Agent.** Eastman Kodak Co. U.S.P. 2,331,664. The essential lubricating and anti-static component of the agent is the ammonium salt of N-oleytaurine. C.

**Mineral Oil-Rosin Alcohol Size: Application.** Hercules Powder Co. U.S.P. 2,331,840. The claim is for the use in sizing of a composition containing a mineral oil and a rosin alcohol or one of its ethers or esters. C.

**Weft-replenishing Loom Yarn Cutter.** Crompton & Knowles Loom Works. U.S.P. 2,331,854. The claim is for means to cut the weft end of a bobbin in discharged position so as to prevent the thread holder from unwinding the bobbin while in this position. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (A)—PREPARATORY PROCESSES

**Sodium Secondary Alkyl Sulphate Solutions: Interfacial Tension against Oils.** R. G. Aickin. *J. Soc. Dyers & Col.*, 1944, 60, 36-40. The interfacial tension of solutions of sodium secondary alkyl sulphates (an olefine fraction treated with sulphuric acid) against a hydrocarbon fraction, olive oil and mineral oils has been measured at 20° C. There is a sharp break in the interfacial tension-concentration curve at the critical concentration, and the concentration at which this break occurs is quite independent of the oil phase. Good



agreement was obtained between the values for the critical concentration obtained by this method and by a flotation method. The addition of electrolytes to the sodium secondary alkyl sulphate solution has a very pronounced effect, reducing both the interfacial tension of the system and its critical concentration. This effect is due almost entirely to the ions of opposite sign to that of the long-chain ions, and in the system investigated it is a positive-ion effect. Divalent ions have more effect than univalent ions, and the latter fall into a lyotropic series. The ions which approach closer to the interfacial film, i.e. the least hydrated ions, have the greater influence on the interfacial tension of the system. The nature of the surface-active species is critically discussed and it is shown that the facts can be satisfactorily explained on the basis that the single long-chain ion is the surface-active entity. C.

(B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Linens: Scouring.** O. A. Samsonova and N. N. Panova. *Prom. Lubyanykh Volokon*, 1940, No. 11-12, 23-26 (through *Khim. Referat. Zhur.*, 1941, 4, No. 6, 113 and *Chem. Abstr.*, 1943, 37, 6902<sup>8</sup>). Addition of bisulphite (36° Bé.) to the boiling lye in an amount equal to 5 c.c./l. facilitates the bleaching of flax fibres, preserves the strength of the fabric and decreases the amount of lye required. C.

(E)—DRYING AND CONDITIONING

**Impregnated Fabrics (Textolite): Drying.** B. N. Rutovskii and A. N. Levin. *Trudy Moskov. Khim.-Tekh. Inst. im. Mendeleeva*, 1940, No. 7, 49-91 (through *Khim. Referat. Zhur.*, 1941, 4, No. 6, 118 and *Chem. Abstr.*, 1943, 37, 6763<sup>8</sup>). The amount of resin transformed into the insoluble state during drying should not exceed 5-10 per cent. The drying velocity curves of saturated fabrics have no breaks; the drying rate decreases continuously. The dependence of the drying rate  $dS/dt$  on  $S$  (percentage of volatile substances of the fabric) and on  $V$  (velocity of the air in m./sec. at 140°) is given by

$$dS/dt = [(0.44S^2 + 3) \times 10^{-4}] / [S^2/(V+4) + 10] \text{ g./sec./sq. cm.}$$

Experiments are described that led to the production of Textolite with improved properties, accelerated the performance of impregnating machines, and recovery of alcohol by absorption. C.

(H)—MERCERISING

**Cotton Shirting Cloth: Mercerizing.** A. C. Tate. *Textile World*, 1943, 93, No. 4, 84-5, 95. The following results were obtained in a series of experiments on mercerizing a 136×60 shirting made from combed American cotton and scoured before treatment. *Concentration of caustic soda:* Best lustre, dye affinity and value for money were obtained with 45° Tw. caustic soda. A few samples gave better lustre at 60° Tw., but these results were inconsistent. Poorest lustre was obtained at 70° Tw. In liquors below 45° Tw. the lustre and dye affinity were distinctly poorer. *Duration of treatment:* No practically important difference was observed between results at cloth speeds of 25 and 75 yards per minute. The higher speed was therefore adopted though involving a reduction of the immersion time to half that recommended by some authorities. *Temperature:* Samples obtained at room temperatures of 70-90° F. were satisfactory, but better lustre was secured at 40° F. A cooling system fed by spring water was beneficial, but refrigeration plant was judged not to be worth the cost. At temperatures approaching 120° F. there was little falling off in lustre, but the cloth became slightly harsher to the touch. *Mixing the mercerizing liquor:* It was found advisable to have mixing tanks for the caustic soda to which fresh, concentrated liquor was fed continuously so as to avoid the heat effect of diluting large batches; in one such case, the temperature rose to 170° F. Variations of concentration within 5° Tw. made little difference and an air-operated semi-automatic device was sufficient to control concentration within 2-3° Tw. *Washing off:* Tests were made on many types of fabric. It was found desirable to maintain wash waters at 170-180° F. and not allow them to become more concentrated than 8-10° Tw. Safe limits for residual alkali are 0.1-0.3 per cent. NaOH for fancy and light goods (5-6 yards per lb.), 0.25-0.50 per cent. for poplins, shirtings, etc. (4-5 yds. per lb.) and 0.4-0.8 per cent. for heavier goods (3-4 yds. per lb.). *Effect of scouring and penetration:* Tests on identical fabrics but some in the grey and others scoured before mercerization showed no appreciable difference in lustre. A penetrant helped to increase the rate of absorption of caustic soda but had no effect on lustre. C.



**(I)—DYEING**

**Dyes: Solubilization in Non-aqueous Solvents.** S. R. Palit. *Nature*, 1944, 153, 317. It is pointed out that in studies of solubilization of dyes by resins errors may arise because some dyes ordinarily regarded as insoluble dissolve in traces in hydrocarbons to give colourless solutions that develop colour in the presence of the dissolved resin (solubilizer). For example, rhodamine dissolves slightly in benzene or toluene to give a colourless solution that becomes pink on dissolving even a fraction of 1 per cent. of resin in it. Hence it is always necessary to check against such "false" solubilization by noting the effect of adding the solubilizer to the dye-saturated solvent. Tests have been made with crystalline abietic acid, purified glycerol triabietate and soft resin of shellac, in 0.5 per cent. solution in toluene and benzene at room temperature. Increase of temperature favours solubilization. About 50 pure and commercial dyes have been tried, of which only about 10 have shown true solubilization. A list is given. The author regards solubilization by resins in non-aqueous solvents as a manifestation of the liquid-like behaviour of resins, which might perhaps be ultimately due to the strong association tendency of the resin molecules, leading to formation of association dimers and polymers with the dye molecules. C.

**m-Halogenophenols: Diazo Coupling.** H. H. Hodgson. *J. Soc. Dyers & Col.*, 1944, 60, 43-45. The unique mono-coupling of *m*-fluorophenol with diazotised aniline, etc., in 4-position, and the mono- and di-coupling of the other *m*-halogenophenols in 4- and 2:4-positions, respectively, are discussed from the standpoint of hydrogen bonding and the theory of resonance. The consequent chromo-isomerism which arises in the 3-halogeno-4-benzeneazophenols and in 3-nitro-2-naphthylamine can be adequately explained on the resonance theory. C.

**Acenaphthenequinone Derivative Dyes: Production.** S. K. Guha. *J. Indian Chem. Soc.*, 1943, 20, 37-39 (through *Chem. Abstr.*, 1943, 37, 6897<sup>3</sup>). Details are given of the preparation of 2-(7-methyl)thionaphtheneacenaphthyleneindigo (1), 7-methyl-3-hydroxythionaphthene (2), 2-(7-methyl)thionaphthene-8'-(3'-(chloro)- (3), -3'(bromo)- (4), and -(1'-methoxy)acenaphthyleneindigo (5), and 7,7'-dimethylthioindigo (6). Products 1, 3, 4 and 5 form red needles, m.p. 304°, 274°, 264.5°, and 300°, respectively, and dye wool red from an acid bath. Products 1, 3 and 4 dye cotton red from the hydrosulphite vat, but 5 gives cotton a faint pink shade. No. 6 forms dark red needles, and gives with concentrated sulphuric acid a deep green solution from which water precipitates the original substance. It dyes wool dark violet-red from an acid bath and cotton violet-red from the hydrosulphite vat. C.

**Acetate Rayon Fully-fashioned Hosiery: Dyeing.** *Textile World*, 1943, 93, No. 4, 107. A brief review is given of recent developments in the use of acetate rayon for fully-fashioned hosiery, with hints on throwing, knitting, scouring, dyeing and finishing. Typical constructions are 75-den. 45-gauge leg with foot reinforced by cotton and toe reinforced by nylon, and 55-den. 51-gauge with nylon-reinforced toe. A recent innovation has 2-ply 60-den. yarn (30-den. singles). C.

**Olive-drab Army Underwear: Dyeing.** O. W. Clark. *Textile World*, 1943, 93, No. 4, 104-105. Recipes and dyeing procedures are given for the olive-drab vat dyeing of American Army underwear fabric, in the piece, or in yarn or loose fibre form, and the pad or jig dyeing of poplin or muslin for shorts. C.

**Dye Solutions: Capillary Rise in Paper.** R. E. Liesegang. *Kolloid Z.*, 1943, 103, 95-96 (through *Chem. Abstr.*, 1943, 37, 6517<sup>8</sup>). Coloured photographs are given of patterns obtained when dye solutions are permitted to rise in paper through capillary action. The patterns are formed by the precipitated dye. If barriers, in the form of cuts, are placed in the paper in the path of the capillary rise of the liquid, patterns are obtained which have an incidental resemblance to optical patterns. C.

**Methylcellulose Solution: Viscosity; Effect of Substantive Dyes.** G. Centola. *Ricerca sci.*, 1940, 11, 905-906 (through *Chem. Zentr.*, 1941, i, 2724-2725 and *Chem. Abstr.*, 1943, 37, 6898<sup>9</sup>). In order to obtain a better insight into the nature of the substantive dyeing of cellulose fibres, a study was made of the change in the specific viscosity of a special methylcellulose (OMe=22.3 per cent.) in aqueous solution produced by the addition of substantive dyes of the Congo

red type in the ratio of 1 mol. of the dye to 100 glucoside groups of the methylcellulose. The results support the hypothesis that complexes between the dye and the methylcellulose are formed in the solution. The dyes which are most effective in increasing the specific viscosity are those having the  $\text{NH}_2$  groups on one side and the lyophilic groups on the other side of the Z plane of the dye molecule, such as Congo red itself and Benzopurpurin 4B. The activity is reduced as the number of OH and  $\text{SO}_3\text{H}$  groups is increased. C.

**Spectrophotometer: Application to Dyeing Problems.** E. I. Stearns. *Amer. Dyes. Rept.*, 1944, 33, 1-6, 16-20. The colorimetric interpretation of curves obtained with the General Electric Co.'s automatically recording visual range spectrophotometer, and the use of such curves for the identification of dyes, the prediction of the colours of mixtures and the quantitative analysis of mixtures are explained. Practical applications of the spectrophotometer to problems of colour matching, the evaluation of competing dyes, dye standardisation, fastness evaluation, maintenance of standards, determination of tolerances, dye identification, optimum dyeing conditions, exhaust analyses, explanation of anomalous visual phenomena, exhaustion rates, and infra-red measurements are discussed. C.

**Blended Wool Light Fastness Standards: Preparation. Light Fastness Standards: Development.** See Section 5C.

**Afterchrome Dyeing: Minimum Chrome Necessary.** H. E. Millson. *Amer. Dyes. Rep.*, 1943, 32, P502-510, 512. The amount of bichromate absorbed by wool is a function of pH, total acidity, concentration of bichromate and time, and follows an absorption isotherm. At low concentrations the bichromate is quantitatively absorbed and completely reduced; at higher concentrations there is a mixture of reduced and unreduced bichromate. The main reaction with the dye is with the chromic salt. Visual and spectrophotometric methods are outlined for determining the optimum amount of bichromate for individual dyes. The amount necessary for optimum results for normal chrome dyes is half that used in practice to-day. Practical dyeings show satisfactory results using 0.125-0.3 per cent. bichromate for 0.25 per cent. of dye or less based on the weight of the wool; for more than 0.25 per cent. of dye the amount of bichromate should be  $\frac{1}{4}$  of the amount of dye but greater than the quantity used for 0.25 per cent. of dye. W.

**Wool Dyeing: Microscopical Observations.** W. H. Watkins, G. L. Royer and H. E. Millson. *Amer. Dyes. Rep.*, 1944, 33, P52-68. A study of the effect of time and temperature on the absorption and diffusion of dye into individual wool fibres. In plant experiments, several 500 lb. lots of worsted skeins were dyed an olive drab with chrome dyes in a rotary type machine, samples being removed and the temperature recorded every 5 min. The most noticeable variations in shade occurred at 135-150° F. and 165-190° F., but critical points varied with different dyes and dyeing methods. When the temperature of one side of the machine was 100° F. and that of the other side 110° F. there was no significant difference in shade, but a difference of 10 degrees for 10 min. at 180-190° F. caused the hotter side to become darker. Unlevel results, e.g. with sulphon cyanines, were due to changing the steam pressure within the critical temperature range. Skeins were dyed in the laboratory with various acid, top chrome, metachrome and Calcofast colours. Cross-sections were prepared by Hardy's method (U.S. Dept. Agric., Circ. 378), and the number of undyed, ring dyed and completely dyed fibres counted by a projection method, a total count of 200-250 giving a representative average. Graphs are given showing the fibre levelness for each dye at different periods during dyeing, photomicrographs showing the corresponding fibre cross-sections. The influence of various pre-treatments was investigated, the critical temperature being lower the greater the damage to the wool. A typical metallized dye produced fibre levelness from the start of dyeing on alcoholic potash treated wool, unlevel results being obtained on untreated wool. W.

#### (J)—PRINTING

**Pigments: Application to Textiles.** E. Sewell. *Textile Manufacturer*, 1944, 70, 84-5, 78 (from *Canadian Textile J.*). A general, practical account is given of the qualities of pigments and methods of application (especially for mineral

khaki), and the preparation of cloth for pigment printing, including the use of cellulosic and other plastic binders. C.

**Rayon Velvet and Plush: Printing.** S. Wigfall. *Textile Manufacturer*, 1944, 70, 79-81. A general, practical account is given of the "dressing" and printing of rayon pile fabrics by direct and discharge methods. Suitable recipes are given for viscose and cellulose acetate rayons. C.

#### (K)—FINISHING

**Aliphatic Finishing Agents: Application.** H. B. McClure. *Rayon Textile Monthly*, 1944, 25, 30-32. A general review of the newer aliphatic chemicals produced by the Carbide and Carbon Chemicals Corporation. The following are mentioned. *Trimethylcyclohexanol*; a product that resembles menthol and is a useful source of the trimethylcyclohexyl group. *Ethylbutyl "Cellosolve"*; useful in dry-cleaning soaps and a solvent for dyes. *Diethylhexyl phthalate*; a plasticizer known as "Flexol." *2-Ethylhexan-1:3-diol*; an effective mosquito repellent. *Polyethyleneglycols*; including plasticizing agents and the "Carbowax" lubricants, soluble in water. *Glycol-cellulose* compounds; water-soluble film-forming agents. *Glyoxal*; 30-40 per cent. solution or the solid bisulphite compound. *Isophorone*; b.p. 215°C., but an excellent solvent for nitro-cellulose or Vinylite resins. *Tergitols*; sodium alkyl sulphates of the higher alcohols. *Tetraethanolammonium hydroxide*; a strong base that decomposes when heated. *Methyldiethanolamine*; a dyestuff intermediate. *Thialdine*,  $C_6H_{13}NS_2$ . *Thiodiethyleneglycol*; a solvent for dyes, sold as "Kromfax." C.

**Lacquer Coated Fabrics: Production, Properties and Uses.** D. McBurney. *Modern Plastics*, 1944, 21, No. 5, 93-95, 172, 174. The production and properties of fabrics with lacquer-type coatings are briefly described, and examples of the coated fabrics used for various military purposes, e.g. raincoat and tent materials, jungle hammock canopies, blanket coverings, life preserver and kit covers, etc., are discussed. C.

**Rayon Crêpe Fabrics: Finishing.** F. Pickering. *Textile Manufacturer*, 1944, 70, 81. Practical hints are given on the examination of goods in the grey room, the actual preparing and crêpeing, and the dyeing and finishing of rayon crêpes. C.

**Cotton Fibre: Effects of Acetylation.** R. Haller. *Kleppzig's Textil-Z.*, 1942, 45, 431-434 (through *Chem. Zentr.*, 1942, ii, 1646 and *Chem. Abstr.*, 1943, 37, 6901<sup>b</sup>). Oxidation with hypochlorite has no effect on acetylated cotton or acetate rayon, and no differences in dye deposition were found by saponification of the acetylated fibre. Acetate rayon was not changed by oxidising agents such as 1 per cent. chromic acid, 30 per cent. Perhydrol (Merck) or permanganate. In cellulose acetates prepared from cotton by neutral catalysts solubility tests in cupri-ethylenediamine and dyeing with Benzopurpurin 4B showed no selective action of the acetylation agent. A selective acetylation of native cellulose fibres could not be established. C.

**Alkali-soluble Cellulose Ethers: Use in Finishing and Sizing.** J. A. Clark. *Amer. Dyes. Rept.*, 1944, 33, 9-13. The preparation of the alkali-soluble cellulose ether "Ceglin" and of solutions of this product is briefly described. Ceglin is prepared in four viscosities, two for the production of crisp and firm finishes and two for softer and fuller finishes. Application to textiles involves, in general, saturation of the fabric with Ceglin solutions of appropriate concentrations and type by pad, mangle, back filler or similar equipment, followed by coagulation by treatment with acid or by removal of the greater part of the water. Examples of the production of laundry-resistant crisp finishes on table damask and stiff finishes on interlinings are discussed. The use of Ceglin for the finishing of rayons is also discussed. Ceglin forms an excellent binder for mineral fillers and pigment colours and may be used as a thickener in printing. The use of Ceglin for warp sizing is described and its advantages for this purpose are pointed out. C.

**Double Crabbing.** *Dyer*, 1944, 91, 57, 59, 69. Variations in cover and weight of the more usual types of dress coatings may arise in piece dyeing, the time of dyeing having a pronounced influence on unset cloths. The use of yarn-dyed wool obviates these faults, but introduces others, due to the difficulty of setting yarn-dyed wool. Double crabbing is advocated, the second setting being done

at a temperature not less than that of the dyebath; steam is applied to the cloth in roll form at not more than 15 lb./sq. in. The pH of the crabbing liquor should be approximately 9.1, and to obtain this a 2 per cent. borax solution is used. The effect of crabbing on the rate of milling as judged by change in physical dimensions and amount of cover is discussed, the former being accelerated and the latter retarded. W.

#### (L)—PROOFING

**"Puratized" Mildew-proofed Fabrics: Production.** C. E. Greeves-Carpenter. *Textile Manufacturer*, 1944, 70, 82. A brief summary is given of the various organo-mercuric compounds employed, as emulsions, dispersions, or solutions in hydrocarbons or cellulose solvents under the name "Puratized" for Service fabrics in the United States. C.

**American Army Flame-proofed Cotton Duck: Production.** W. W. Chase. *Textile World*, 1943, 93, No. 4, 90. Federal Specification CCC-D-746 covers a cotton duck that is flame-proof, resistant to water and mildew, not injurious to the skin, and as flexible as the untreated cloth even after heating for 72 hours at 158° F., and one that must not crack or crease when cooled for 6 hours at -20 to -35° F. The writer reviews work (chiefly by Leatherman) that has led to the use of a mixture of chlorinated paraffin wax (16 per cent.) synthetic resin (12), plasticizer (2), metallic oxide pigment (15), composition to give the olive-drab colour (15) and volatile organic solvent (40). The mixture is applied in a mangle and the aim is to add 45-50 per cent. to the weight of the cloth. It is said that the drawback to stannic oxide (as in the Perkin process) is that whilst it checks inflammation it promotes flameless combustion ("afterglow") and tendering by light. C.

**Rubber and Petroleum: Deposition on Cotton.** S. S. Voyutskii and E. M. Dzyadel. *Prom. Lubyanykh Volokon*, 1940, No. 11-12, 26-28 (through *Khim. Referat. Zhur.*, 1941, 4, No. 6, 113 and *Chem. Abstr.*, 1943, 37, 6900"). On cotton fibres aqueous suspensions of rubber and emulsions of paraffin or liquid petrolatum are irreversibly sorbed (the emulsion of paraffin most, and liquid petrolatum least). The velocity of sorption and the bond between the hydrophobing agent and the fibre are greatest with rubber. A preliminary treatment with hydrochloric acid and aluminium sulphate increased the amount of the rubber and of paraffin sorbed and deposited on the fibre. C.

**Tall Oil: Use in the Textile Industry.** R. Hastings. *Amer. Dyes. Rept.*, 1944, 33, 25-26, 50. Tall oil is the natural mixture, consisting primarily of fatty and rosin acids, recovered from pine wood in the alkaline paper pulp process. Physical, chemical and analytical data for crude and refined oils are presented. Directions are given for the preparation of a liquid soap of tall oil for use in the scouring of wool, rayon, and cotton linters, the kier boiling of cotton, the degumming of silk, and the removal of pitch from rayon pulps. Tall oil, when sulphonated, gives a product similar to turkey red oil which may be used as a wetting, softening and lubricating agent. Metallic soaps of tall oil are useful for waterproofing and mildewproofing textile materials. C.

**Proofed Service Fabrics: Soil Burial Tests.** See Section 5C.

**Rubber Compounds: Accelerated Light Ageing Tests.** See Section 5D.

#### PATENTS

**Resin-bonded Laminated Articles: Production.** Brown & Adam Ltd., A. S. Brown and Imperial Chemical Industries Ltd. B.P.559,235 of 23/4/1942: 10/2/1944. A process for producing a shaped article comprises building or wrapping or otherwise disposing in the form of a tube, upon the outside of a temporary tubular former, material, e.g. laminar or filamentary material such as paper, fabric, yarn, rove or fibre, which has been impregnated or bonded with a natural or synthetic resin having thermosetting or thermoplastic properties, covering the tubular material with a liquid-tight protective envelope and subsequently shaping the material in a chamber containing liquid which surrounds the assembly and is in open communication with the interior of the tubular former and which serves as a vehicle for transmitting to the material the heat and pressure necessary to constrain it to the shape of the former. C.

**Wetting, Foaming and Detergent Agents: Production.** National Oil Products Co. (U.S.A.). B.P.559,265 of 11/5/1942:11/2/1944 (Conv. 3/5/1941). Wetting, foaming and detergent agents are produced by condensing one molecular proportion of an aromatic hydrocarbon, e.g. naphthalene, with two molecular proportions of lauryl or myristyl alcohol, or the alcohols derived from the fatty residues of coconut oil, and treating the hydrocarbon with a sulphonating agent, before, during or after alkylation to produce a mono-sulphonated product. C.

**Coloured Glass Fibres, Yarns and Fabrics: Production.** Bleachers' Association Ltd., F. L. Barrett and C. E. H. Charlton. B.P.559,329 of 8/5/1942:15/2/1944. Glass fibres, yarns or fabrics are coloured by applying to them a liquid which in drying and, if necessary heating, will produce a thin, solid, substantially colourless resinous or cellulosic film which is receptive of dyes, removing the greater part of the liquid from the interstices between the individual fibres by squeezing or other means, drying, and if necessary heating, and then dyeing or printing the resulting material by the methods ordinarily used for textile materials of animal or vegetable origin. Suitable substances for the thin, solid film upon the fibres are resinous materials such as natural or synthetic resins, or regenerated cellulose, cellulose ethers and cellulose esters. C.

**Plasticized Polyamide Compositions: Production.** E. I. Du Pont de Nemours & Co. and F. T. Peters. B.P.559,514 of 7/5/1941:23/2/1944. A process for the manufacture of plasticized synthetic linear polyamides comprises incorporating in a synthetic linear polyamide, preferably an interpolyamide, an ester derived from a monocarboxylic acid containing at least 6 C atoms and a polyhydric alcohol in which at least one of the hydroxyl groups is left unesterified together with, if desired, other plasticizing agents and/or modifying agents. Preferred partially esterified polyhydric alcohols are those in which the alcohol constituent is glycerol or a lower glycol. The acid constituent may be aromatic, aliphatic, alicyclic, or a mixture of such acids. The partially esterified polyhydric alcohol and the synthetic linear polyamide may be dissolved in a mutual solvent and the solution used for making filaments, films or rods by evaporative or coagulative methods. C.

**Moisture-proof Sheet: Production.** British Cellophane Ltd. B.P.559,520 of 22/5/1942:23/2/1944 (Conv. 24/5/1941). A moisture-proof sheet or film comprises an organic non-fibrous base sheet or film, e.g. of regenerated cellulose or polyvinyl alcohol, coated with a film-forming agent, e.g. a cellulose derivative, a resin or rubber derivative, a wax, and a condensable or polymerisable urea derivative-formaldehyde resinous material condensed or polymerised by heat to yield the hardened, insoluble form. Urea derivatives, which by condensation with formaldehyde yield suitable condensable or polymerisable urea derivative-formaldehyde resinous materials include monobutylurea, monobutylthiurea, mono-amylurea, mono-allylthiurea, N:N'-di-*n*-butylurea, monocyclohexylurea, monocyclohexylthiurea and monobenzylurea. C.

**Trisazo Dyes: Production.** Society of Chemical Industry in Basle. R.P. 559,680 of 3/4/1942:11/3/1944 (Conv. 3/4/1941). Trisazo dyes are made by coupling 1 mol. of a diazo compound of an aminoazo dye of given formula in an alkaline medium with 1 mol. of 5:5'-dihydroxy-2:2'-dinaphthylamine-7:7'-disulphonic acid, and then coupling 1 mol. of the resulting disazo dye in an alkaline medium with 1 mol. of a diazo compound of an arylamine of another given general formula. In an example, 4-amino-2-methyl-5-methoxy-4'-hydroxy-3'-carboxy-1:1'-azobenzene is diazotised and coupled with 5:5'-dihydroxy-2:2'-dinaphthylamine-7:7'-disulphonic acid and the product is coupled with the diazo compound prepared from 1-amino-2-methoxy-5-methylbenzene. Alternatively, the dyes can be prepared by first coupling the diazo compound of the arylamine with 5:5'-dihydroxy-2:2'-dinaphthylamine-7:7'-disulphonic acid and then coupling the resulting monoazo dye with the diazo compound of the aminoazo dye. The dyes produced in this way dye natural and regenerated cellulose fibres, films, etc., reddish blue tints, which on treatment with copper salts become more greenish and fast to washing and light. C.

**Disazo Dyes: Production.** Manchester Oxide Co. Ltd., B. Bann, W. Taylor, G. Gladding and P. Krug. B.P.559,784 of 7/8/1942:6/3/1944. Insoluble azo compounds are obtained by tetrazotising a symmetrical diamino disulphide of

given general formula and coupling the product with an arylamide of a hydroxy carboxylic acid having the hydroxyl and carboxyl groups on adjacent carbon atoms (such as 2:3-hydroxynaphthoic acid or 2-hydroxycarbazole-3-carboxylic acid) or of a  $\beta$ -ketonic acid (such as acetoacetic acid). Specified diamino disulphides include 2:2':5:5'-tetramethyl-4:4'-diaminodiphenyl disulphide and 5:5'-dimethyl-4:4'-diaminodiphenyl disulphide. The resulting disazo compounds may be dyes or pigments. Cellulosic textile materials may be impregnated with one of the components and then treated with the other component so that the azo dye is produced *in situ*. The dyes are characterised by good fastness to soda ash boiling and to kier boiling and by high intensity of shade. C.

**Mercuri-acetylide Mildew Antiseptic.** Research Corporation. U.S.P. 2,329,883/4. Symmetrical, organic mercury compounds of the formula (A)·R·Hg·C≡C·Hg·R(A) are claimed as mildew-preventives; (A) is the group -CO·N< or -SO<sub>2</sub>N<, and R is an aliphatic or alicyclic radical directly linked to N in the group (A). C.

**Hydroxyalkylcellulose Esters: Production.** Carbide and Carbon Chemicals Corporation. U.S.P. 2,330,263. A dry hydroxyalkylcellulose derived from unmercerized cellulose is treated with a lower fatty acid anhydride and then with an esterifying bath containing lower fatty acid anhydride and a catalyst. C.

**Elastic Tension Cloth: Finishing.** Herman Mieth (Louisville, Kentucky). U.S.P. 2,330,441. A silk fabric is impregnated with a solution of rubber in turpentine, petroleum benzine, carbon disulphide or ether, dried, treated on one face with a solution consisting of turpentine (10 parts by weight), ether (2), alcohol (5), beeswax (5), and camphor (5), and dried again. The cloth is specifically adapted to musical instruments, air motors and aeroplanes. C.

**Cellulosic Fabrics: Patterning with Acetate Rayon Dyes.** Röhm & Haas Co. U.S.P. 2,330,775. Fabrics composed of cellulose or regenerated cellulose are increased in affinity for acetate rayon dyes but decreased in affinity for direct dyes by local impregnation and heating with a solution containing 10-25 per cent. of a compound of the formula RO·CH<sub>2</sub>·NR<sub>1</sub>R<sub>2</sub>R<sub>3</sub>X, where R is an aliphatic, cycloaliphatic or aralkyl group of 7-14 C atoms, X is an anion, and R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub> are groups at least one of which has the N atom in a heterocycle. C.

**Aircraft Fabric: Proofing in Position.** Roxalin Flexible Finishes, Inc. U.S.P. 2,330,998. Textile fabric is attached to a structural framework of an aircraft, treated with water and a mildew-proofing agent, dried and given in the taut condition a protective coating of cellulosic dope. The mildew-proofing agent may be contained in the dope. C.

**Cloth Drying Machine.** R. C. Parkes (Glenside, Pa.). U.S.P. 2,331,042. The cloth passes through a drying chamber between the flared nozzles of an upper and lower row of blowers. One set of nozzles is fixed and the other adjustable so that upper and lower nozzles are in vertical register or not, as desired. Thus, surface or "penetration" drying is effected. C.

**Cellulose Ether Plasticizer.** Dow Chemical Co. U.S.P. 2,331,090. A cellulose ether is plasticized by means of a  $\beta$ -aryloxy- $\beta'$ -chlorodiethyl (or -dipropyl) ether of the formula C<sub>6</sub>H<sub>4</sub>X<sub>2</sub>Y·O·Alk·O·Alk·Cl, where one X is phenyl, alkyl (up to C<sub>6</sub>) or Cl, the other X is aralkyl, tert. alkyl, or Cl, and Y is aralkyl or H. C.

**Thermoplastic Cellulose Ether and Resin Stiffener.** Dow Chemical Co. U.S.P. 2,331,095. A stiffening medium consists of about 17.5 per cent. of a cellulose ether, 7.5 per cent. of a plasticizing agent and 75 per cent. of a natural resin; it forms a viscous, adhesive melt at 150° C. but is tough and not tacky at room temperature. C.

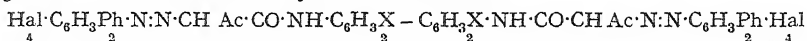
**Thermoplastic Self-binding Composite Fabric: Production.** Beckwith Manufacturing Co. U.S.P. 2,331,321. Fusible and non-fusible fibres are mixed and formed into a bat which is needle-punched upon a woven fabric base, and the two plies are then consolidated under heat and pressure. C.

**Hydroxycyclohexanone Ester Plasticizers: Production and Application.** Monsanto Chemical Co. U.S.P. 2,331,328, 2,331,329, 2,331,330. The second patent claims the production of carboxylic esters (e.g. the monophthalate) of hydroxycyclohexanones by the interaction of a halogenated cyclohexanone with

an alkali salt of the acid in the presence of the acid under anhydrous conditions. The first and third patents claim plastic compositions in which these esters are used with vinyl acetal resins and cellulose esters or ethers, respectively. C.

**Finishing Composition.** American Cyanamid Co. U.S.P.2,331,579. The composition consists of high fatty acid glycerides, their sulphonation products, and, as stabilizing agent, a metal bisulphite-formaldehyde compound. C.

**Yellow Insoluble Azo Dye.** American Aniline Products, Inc. U.S.P. 2,331,812. The claim is for dyes of the formula



in which X is H or Me. The dyes are insoluble in water and when produced on the fibre give vivid yellow shades of very good fastness to light and to washing. C.

**Polyvalent Metal Salt Solutions of Cellulose-glycollic Acid: Preparation.** Dow Chemical Co. U.S.P.2,331,858/9. (2) A solution of the sodium salt of cellulose-glycollic acid is mixed with a solution of an aluminium salt in such a way that the pH is maintained between 4.5 and 7. The Al salt remains in solution. (1) A normally insoluble polyvalent metal salt of cellulose-glycollic acid is brought into solution by dissolving it in alkali and cautiously acidifying the solution until the pH is reduced at least to 7. C.

**Cellulose Ethers Soluble in Cold Water: Production.** Dow Chemical Co. U.S.P.2,331,864/5. (1) A fibrous cellulose ether that is soluble in cold water is transformed into a more readily soluble powder by adjusting its water content at above 50° C. to 72-88 per cent., cooling to below 50° C., maintaining the mass at the lower temperature until it becomes translucent and without visible fibrous structure, and then immediately drying the product at above 50° C. and grinding it. (2) The fibrous cellulose ether containing 2-88 per cent. of water is compressed at below 50° C. until the mass becomes a translucent gel. C.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**American Upland Cotton: Staple Length.** *J. Amer. Soc. Agron.*, 1943, 35, 491-498 (through *Plant Breed. Abstr.*, 1944, 14, 60). A highly significant correlation coefficient ( $r = +0.89$ ) has been found between combed staple length on the cotton seed and commercial staple length determinations. C.

**Argentine Cottons: Uniformity.** *Boletín Mensual, Junta Nacional del Algodón, Buenos Aires*, 1943, No. 85, 137. Staple diagrams are given of (1) a long (34 mm.)-fibre variety of cotton grown in the province of Salta, (2) a variety of medium (26 mm.) length which forms the bulk of the crop, and (3) the Chaco type which was previously grown in the Republic. The greater uniformity in length shown by (1) and (2) is pointed out and its advantageous effect in spinning is indicated. C.

**Cotton Grass Seed Hairs: X-ray Diagram; Influence of Fat and Wax Content.** K. Hess, H. Kiessig and W. Wergin. *Ber. deut. chem. Ges.*, 1943, 76 B, 449-452 (through *Chem. Abstr.*, 1943, 37, 6650). Gralén, Berg and Svedberg determined the cellulose, uronic acid, methoxyl and pentosan contents of *Eriophorum* (cotton grass) seed hairs and found that no lignin is present. They also observed that the Röntgen diagrams of the untreated hairs do not correspond exactly with the interferences of native cellulose and that the cellulose cannot be extracted with cuprammonium hydroxide. They suggest that the insolubility of lignified cell walls may be due not to the protective action of lignin, but to the presence of hemicellulose. Comparison with Röntgen diagrams made by the authors shows, however, that the diagrams of the Swedish investigators represent a superposition of the interferences due to the fat and wax phase on those of cellulose. The very strong interference  $d = 4.09 \text{ \AA}$ . in the diagram of the hairs is a superposition of the intense fat and wax ring  $d = 4.14$  on the strong cellulosic interference  $A_1$  of cellulose ( $d = 3.89$ ); the interference  $d = 3.70 \text{ \AA}$ . corresponds to the interference  $d = 3.75 \text{ \AA}$ . of fat and wax,



and the interference  $d = 5.50 \text{ \AA}$ . corresponds to the reflexes  $A_1$  and  $A_2$  of cellulose. The diagram of the hairs can thus be satisfactorily explained by the presence of wax and cellulose and there is no reason for assuming a shifting of the cellulose interferences. When the fat and wax phase is extracted with chloroform the superposition in the diagram disappears and the residue recovered from the extract shows the known fat and wax interferences. The insolubility of the cellulose in the untreated hairs is also less a result of pectin or hemicelluloses than of the wax surrounding the cellulose-pectin complex. The hairs show a different picture when, after removal of fat and wax, they are extracted with hot caustic soda (not more than 6 per cent., to avoid conversion into cellulose hydrate); the cellulose interferences now develop completely, with the strong intensity of normal secondary-wall cellulose. C.

**Natural and Man-made Fibres: Structure.** E. Franz, F. H. Müller and L. Wallner. *Forsch.-Ber. Zellwolle-u. Kunstseide Rings. G.m.b.H.*, 1942, No. 2, 75-83 (through *Chem. Zentr.*, 1942, ii, 1646 and *Chem. Abstr.*, 1943, 37, 6901<sup>6</sup>). The fibres were treated with a swelling agent (but not a solvent; e.g. 18 per cent. caustic soda for celluloses) and squeezed between glass plates at a definite pressure. Microscopic examination of these preparations showed differences in their inner structure. Distinct spiral structure was shown in natural fibres but not in rayons. Lilienfeld rayons spun under increasing tension showed increasing disintegration into thin strands. Görg rayon, treated in strong alkaline baths, showed stronger orientation parallel to the fibre axis than Lilienfeld rayon. Highly polymerized fibres, such as Telusa WI and Teluret, show a fine structure; this may explain the high wearing quality of such rayons. Casein and protein fibres spread out extensively in the squeezing-out treatment. Completely synthetic fibres show no strand formation. C.

**Wool: Micro-structure.** H. Reumuth. *Textilberichte*, 1942, 23, 53-58 (through *Chem. Zentr.*, 1942, i, 3053 and *Chem. Abstr.*, 1943, 37, 6901<sup>8</sup>). By comparing photographs made with the visual and the electron microscope a better picture of the structure-pattern of single cells in the fibre is obtained. The fibrils, like growing cells, contain developed or rudimentary cell nuclei. Cross-section studies with the Pauly diazo reagent show the localization of the degradation products histidine and tyrosine. The effects of boiling water and solvents are pictured. C.

#### (B)—YARNS

**Rayon Yarn: Tensile Testing; Rate of Loading.** H. R. Mauersberger (based on work by A. G. Scroggie). *Rayon Textile Monthly*, 1944, 25, 15-16. Specification D-258 (1942) of the American Society for Testing Materials stipulates a rate of loading of 4 grams per denier per minute in tensile tests on rayon yarns. It is pointed out that the newer high-tenacity yarns render this requirement untenable for most testing machines and a revision of the test is proposed. To provide evidence, breaking load data and load/extension curves obtained by autographic testers of the inclined-plane type are reproduced for a wet 1000-den. tyre yarn. Table I shows the effect of increasing the weight of the loading carriage in steps from 5 to 50 lb., the time to apply full load being constant at 40 seconds. Table II shows the effect of reducing the time in steps from 100 to 3 seconds, the load being constant at 10 lb. Table III gives a few results of changing both load and time so that the rate of loading in grams per denier per minute ranged from 4.2 to 134.0. It is recommended that the rate of loading should be varied so that "the speed of operation of a testing instrument of the constant-rate-of-loading type shall be such that the specimen will break in approximately 30 seconds, and, in any case, within a period of 20-40 seconds after application of the load." Further, "on specimens having a strength above 0.7 gram per denier, the mass of the carriage used shall in no case be greater than three times the breaking load of the specimen." C.

**Yarn: Selection for Weaving.** K. S. Saxena. *Indian Textile J.*, 1943, 54, 109. The chief features required in yarns for warps and wefts are specified, and the influence of reed and pick of cloth and nature of weave on the selection of yarns is discussed. The testing of the yarns, the influence of yarn counts on cloth quality, and the tension and friction on yarns in weaving processes are briefly considered. C.



**Yarn Count and Length Calculations.** R. Khande Rao. *Indian Textile J.*, 1943, 54, 115-116. Explanations and examples are given of new methods, based on fundamental principles, of calculating (1) warp and weft counts in a sample of cloth, (2) length of yarn in yards on a warper's bobbin, (3) length of yarn in yards on a weft pirn produced on a Universal pirn winding machine, and (4) length of yarn on a weft pirn produced on a cup pirn winding machine. C.

(C)—FABRICS

**Work Garment Fabrics: Physical Properties.** Margaret B. Hays. *Rayon Textile Monthly*, 1944, 25, 28-30. A systematic study has been made of the following 26 materials sold for working garments: gabardines (10 sorts), osnaburgs (2), poplins (4), jeans (2), herringbone twill (1), whipcord (3), suitings (2), pin check (1), and sports-wear denim (1). The following data are tabulated and discussed in general terms: (1) count of warp and weft and type of warp yarn, (2) weight per sq. yd., (3) thickness, (4) breaking load, warp-way and weft-way, (5) loss of weight on desizing, (6) shrinkage, warp-way and weft-way, and (7) resistance to abrasion in the Taber and Wyzenbeek tests. Some fabrics resisted abrasion better in one direction, warp or weft, and the suggestion is made that garments should be cut accordingly. C.

**Blended Wool Light Fastness Standards: Preparation.** H. Christison. *Amer. Dyes. Rept.*, 1944, 33, 33-38. Proposed new standards for light fastness have been prepared by making two separate slub dye wool dyeings, one fugitive, the other fast, and blending them mechanically to produce the wanted fastness steps. The dyeing of the fugitive component was made by using 0.4 per cent. Erio Chrome Azurole B, or Colour Index No. 720, and for the fast component 3 per cent. Algosol or Indigosol Blue AGG. Yarns were spun from the blended components and woven into cloth. Samples were exposed for periods of 10, 20 and 30 days on the roof and for 10, 20, 40, 80 and 160 hours under the arc light in the Fade-ometer. Photographs of the faded samples are given together with photographs of the present English, German and American standards after similar exposures. Advantages and disadvantages of the proposed new standards are discussed. C.

**Light Fastness Standards: Development.** W. H. Cady. *Amer. Dyes. Rept.*, 1944, 33, 29-32. A review of the history of research on the fading of dyes and the development of artificial light sources and standards of light fastness. C.

**Defective Army Knitted Goods: Causes.** *Textile World*, 1943, 93, No. 4, 106. Illustrations are given of common defects in knitted garments that lead to rejection. C.

**Elastic Webbing: Measurement of Stretch.** G. H. Lunge. *J. Textile Inst.*, 1944, 35, T7-16. C.

**Proofed Service Fabrics: Soil Burial Tests.** E. C. Bertolet. *Amer. Dyes. Rept.*, 1944, 33, 21-24. The disadvantages of laboratory accelerated mildew tests and the advantages of soil burial tests for fabrics for sand bags, tents and other military equipment are discussed. Various procedures are outlined and details are given of the soil burial test procedure used at the Jefferson Quartermaster Depot. Results of tests on water-repellent and fire-, water- and weather-resistant ducks are briefly discussed. C.

(D)—OTHER MATERIALS

**Paper and Sheet Materials: Water Vapour Permeability Determinations; Comparison.** C. G. Weber. *Paper Trade J.*, 1944, 118, TAPPI, 24-26. Water vapour permeability determinations were made on sheet materials, such as glassine, greaseproof board, Pliofilm, Cellophane and ethylcellulose, by the General Foods method of the U.S. Bureau of Standards, a modification by which a constant rate of gain was ascertained, a further modification of the same test which omitted the desiccation step, and the TAPPI Standard T448 m test. Results are tabulated and compared. Approximately the same order was established by the various methods, but the TAPPI method did not differentiate between Renoflex, waxed glassine and three-ply glassine. Greaseproof board showed up well under the TAPPI method, but was given a very poor rating by

the other method. The data indicate the importance of using more drastic conditions than those imposed by the TAPPI method when attempting to predict the performance of a material which is to be used under the more severe conditions of humidity and temperature. The "General Foods" cabinet can be used for testing at high humidity and temperature with fairly satisfactory results if repeated weighings are made until a net rate of gain is established and light covers are used to cover the specimens during weighing so as to eliminate the objectionable desiccation step. C.

**Paper and Sheet Materials: Water Vapour Permeability Determinations; Comparison.** G. R. Sears, H. A. Schlagenhauf, J. C. Givens and F. R. Yett. *Paper Trade J.*, 1944, 118, *TAPPI*, 27-28. Tests on various sheet materials were carried out by the "General Foods" vapour transfer method, the constant rate variation of this method, and the Institute of Paper Chemistry (TAPPI) method. Notes on the procedures are given and the results are tabulated. Agreement between the normal General Foods method and the constant rate variation of that method was good. The values obtained by the TAPPI method were generally lower than those for the other methods. This was particularly the case for three-ply glassine and waxed glassine. C.

**Telephone Cable and Condenser Papers: Properties.** D. A. McLean. *Paper Trade J.*, 1944, 118, *TAPPI*, 33-36. The use of paper in telephone cables and condensers, the properties required for such purposes, and the types of papers employed are discussed. At elevated temperatures and voltages kraft paper condensers have four or five times the life of similar linen paper condensers. Studies of papers from failed or nearly failed condensers showed that decomposed areas of the papers contained free hydrochloric acid which apparently was produced by decomposition of the chlorinated aromatic compound used for impregnating condenser papers. The kraft paper was found to have a higher acid-neutralising power than the linen paper, this power being related to ash content. As a result of these investigations paper condensers of considerably extended life have been developed. C.

**Thermo-setting Laminates: Effects of Thermo-elastic Forming on Properties.** W. I. Beach. *Modern Plastics*, 1944, 21, No. 5, 127-131, 186, 188. Cure/time curves for laminated phenolic sheet show that for all practical purposes the polymerisation takes place in a relatively short period. Tests on samples of a slightly plasticized phenol-resin, fabric-base laminate and a crescyclic-resin, fabric-base laminate processed to normal cure and to various percentages of over-cure showed that laminated sheet material processed far beyond its normal cure still retains its forming characteristics. Material processed below the normal cure is inferior in regard to formability, physical properties, and delamination. A forming operation usually consists of bending or drawing sheet material into objects having simple and compound curves or a combination thereof. Tests have been made with a standard laminated-fabric-base sheet in which the fabric was 8-oz. duck and the binder phenol-formaldehyde resin. Results showing the effects of stretching (1) in the direction of the weft threads, (2) in the direction of the warp threads, and (3) in a direction 45° to the weft and warp threads on the resistance to tension, flexure, shear and impact and on the water absorption of the laminated material are presented in tables and graphs. The results indicate that a wider employment of formed laminates could be made in many applications previously believed unsuitable because of lack of data. Contingent upon the magnitude and nature of the applied load, formed parts may be dealt with in such a manner that they ultimately possess better physical properties than were present in the flat, unformed sheet material. Judicious selection of thread direction is necessary, whether the part has a simple right-angle bend or compound curvature. C.

**Vulcanised Rubber: Stress-Strain Data.** L. R. G. Treloar. *Trans. Faraday Soc.*, 1944, 40, 59-70. Stress-strain data are given for two types of vulcanised rubber: (1) an 8 per cent. S rubber, and (2) a latex rubber. The types of deformation studied were simple elongation, two-dimensional extension (or compression), pure shear, and combined elongation and shear. Comparison with the theoretical relations based on the molecular-network model shows the agree-

ment to be good for the two-dimensional extension, but less good for simple elongation and shear. The effect of combined elongation and shear is satisfactorily accounted for. The theory provides a satisfactory explanation of rubber-like elasticity, and forms a useful basis for the description of the mechanical properties of rubber subjected to large deformations of any type. C.

**Rubber Compounds: Accelerated Light Ageing Tests.** C. K. Chatten and T. A. Werkenthin. *India Rubber World*, 1943, 108, 40 (through *Mark & Proskauer's Resins, Rubber, Plastics Abstr.*, 1943, Sheet 273). The effects of angular and vertical exposures of specimens in the light ageing unit (Eveready X-IA) have been investigated on Hevea rubber compounds and, with the angular exposure method, the variations in temperature and light intensity between the upper and lower levels of the unit have been studied. The results of tensile tests show the equalizing effect of angular exposure in both levels. In both angular and vertical exposures, the specimens in the upper level are deteriorated to a greater extent than those in the lower level. All temperature readings at the upper level are higher than at the corresponding position on the bottom rack. The greatest differences are observed at the point of highest ambient air temperature. The minimum temperatures are obtained under the water spray of the ageing unit. The light intensity varies in approximately the same degree in the upper and lower racks at the various positions in the cycle. The minimum intensity is observed under the water spray. The light dosage appears to be higher, at any point of the cycle, in the bottom than in the top rack. Since the variations at the two levels, however, are of the same order, the dosage can be equalized by elevating the position of the arc. The general conclusion from this work is that angular instead of vertical exposure results in a fairly uniform degree of deterioration at both levels. Other variables which should be standardised are (1) thickness of specimens, (2) surface condition of specimens (buffed or glossy), (3) maximum and minimum temperature at both levels, and (4) temperature, volume and purity of water spray. C.

#### PATENT

**Paper Water-penetration Tester.** J. A. van den Akker (for Institute of Paper Chemistry). U.S.P. 2,329,959. The instrument measures the fluorescent light emitted by a test sheet of paper when irradiated from above by ultra-violet light and wetted from underneath by bringing up to it a vessel of water. C.

## 7—LAUNDERING AND DRY CLEANING

### (A)—CLEANING

**Dry Cleaning Machine: Removal of Water.** O. C. Cessna. *Ldy. Dry Cleaning J. of Canada*, 1944, Feb. 13, 24. Corrosive action due to chlorinated solvents is minimised by the fitting of a water separator in the line between the condenser and the storage tank. Details are given of a separator in which the separation takes place by gravity. La.

**Upholstered Furniture: Cleaning.** R. R. Gregg. *Ldy. Age*, 1941, June, 37, 39, 70. Recommended procedure consists of (1) beating with a short broom-handle, (2) vacuuming, (3) cleaning with a dry solvent using a medium stiff black hair bristle brush, (4) drying. Motor car upholstery is similarly treated. Wet cleaning may frequently be used with safety on modern upholstery in place of dry cleaning. La.

**First Quality Laundering with Less Bleach.** J. F. Oesterling. *Ldy. Age*, 1941, Dec. 18-20. This article discusses ways of utilising bleach to best advantage and compensating for reduction in supplies by improving general washing efficiency. Bleach should be stored in a cool place and protected from contamination by sour. Machines should not be overloaded, even if this necessitates a reduction of process time. The alkalinity of a washing process should be carefully watched and only a minimum of a carefully chosen blue used. La.

## (C)—FINISHING

**Sizing Agents.** "Information," No. 8, Jan., 1944. The article is concerned with the replacement of water-soluble sizing materials removed in wet cleaning by a dry cleaner. The relative lustre, stiffness and handle imparted by various sizing agents is indicated. La.

## 8—BUILDING AND ENGINEERING

## (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Expanded Plastics: Properties.** Expanded Plastics Ltd. *British Plastics*, 1944, 16, 63-65. Expanded plastics have a unique cellular structure. They are permanently buoyant and have a negligible water absorption, an extremely low density, a high strength/weight ratio, and an exceptionally low thermal conductivity. A summary is given of the properties of Thermazote (expanded phenolic resin), Plastazote (expanded polyvinyl formal), expanded polystyrene and expanded polyvinyl chloride, and further details are given of the properties and uses of the first two. The products are used in life-saving apparatus, as thermal insulation, and in aircraft and general construction. C.

**Leather: Structure and Properties.** Dorothy Jordan-Lloyd. *Royal Institute of Chemistry Lecture*, 1943, 31 pp. An illustrated report of a lecture giving an account of the structure and properties of leather under the headings (1) structure of the skin, (2) abrasive resistance, (3) tensile strength, (4) plasticity, elasticity, resilience and permanent set, (5) resistance to flexural fatigue, (6) "handle," (7) porosity and water resistance, (8) hygroscopic properties and variations in area and feel, (9) heat resistance, (10) stability to atmospheric oxidation, (11) appearance, and (12) the rôle of the tannery chemist. C.

**Plastics: Properties and Uses.** S. L. Smith. *British Plastics*, 1943, 15, 391-394; 1944, 16, 84-90. A survey of plastics and their properties, uses, serviceability and methods of testing, with special reference to reinforced plastics and resin-treated woods and their use for structural members and bearings. C.

**Pluswood: Production and Properties.** Pluswood Incorporated. *Rev. Sci. Instruments*, 1943, 14, 381. Pluswood is made by impregnating plies of birch or maple with phenolic resin and subjecting them to simultaneous heat and high pressure. Sheets of the laminate are available in fractional sizes of  $\frac{1}{4}$  in. in thickness up to sheets 7 ft.  $\times$  18 ft.  $\times$  16 in. The product possesses extremely high mechanical, structural and dielectric strength. It has high surface hardness, is impervious to water, mild acids, and alkalis, and is highly resistant to any dimensional change. It is far lighter than aluminium but can handle many of the structural loads of the heavier metals. It requires metal working tools for machining. In a test a cutting torch applied to a  $\frac{1}{2}$ -in. steel plate burned through it in 11 sec., whilst under the same conditions a sheet of Pluswood of the same thickness, which had not been treated for fire resistance, was burnt through in 39 sec. C.

**Plytube: Properties and Uses.** Plymold Corporation. *Rev. Sci. Instruments*, 1943, 14, 380-381. Plytube is a light-weight plywood tubing which has found a variety of uses from sectional life-raft oars to radio-antenna masts. Four types of veneer are used and the lay of the winding is adjusted to meet specific requirements. Urea-formaldehyde is used as a thermo-setting bonding agent. Plytube is at present being manufactured with internal diameters ranging from 0.5 to 24 in. and wall thicknesses from 0.05 to 0.50 in. Veneers used run down to 0.01 in. in thickness. Tubes have been fabricated with  $\frac{1}{4}$  in. outside diameter. The tubes take on the resistant properties of the plastic resin bonding agent and are flame-, splinter-, water-, and rot-proof. They have low electrical conductivity and are dimensionally stable under extreme temperature variation. Special coatings make them adaptable for use as containers or conduits for chemicals, oils, etc. The tubes can be threaded with ordinary pipe dies. Straight threaded unions, flanged joints, internal and external sleeve joints have been made. The tubes have high strength for light weight. Results of tests on small-diameter tubes are given. C.

**Uskon Electrically Conducting Rubber: Properties and Uses.** United States Rubber Co. *Rev. Sci. Instruments*, 1943, 14, 380. Uskon rubber, a synthetic material having considerable electrical conductivity, has been developed for use as a dissipator of static charges, and to eliminate danger of mechanical sparks.

It is black and is made in various densities from medium-soft to hard. Volume resistivity can be as low as 5,000 to 10,000 ohms per cm.<sup>3</sup>, although this is much lower than is usually required for static protection. The product has been used for transmission belts, containers, hose, tubing, matting, ammunition buckets, powder trays, etc., and as a heating element. An electric current passed through a strip of this rubber attached to the leading edge of aeroplane propeller blades provides sufficient heat to prevent ice formation. C.

**Vibration Dampening Device.** Vibration Engineering Co. (New York). *Rayon Textile Monthly*, 1944, 25, 42. An illustration is given of a vibration dampening device for mounting machinery in which two rubber blocks are bonded to metal so shaped that the loaded rubber is under shear and compression and the consequent internal friction interrupts any waves of vibration. The device is made in four rubber hardnesses, 40, 50, 70 and 105 lb. loading per linear inch. C.

**Centrifugal Pumps: Conservation.** B. L. Cody. *Chem. & Eng. News*, 1943, 21, 2103-2106. A general time table for inspection and maintenance is outlined and directions are given for dismantling a pump, installing a new gasket, and packing a stuffing box. Methods of increasing pump capacity are discussed. C.

**Machinery: Reduction of Vibration.** A. Gemant. *J. Applied Physics*, 1944, 15, 33-42. This paper deals with considerations concerning the reduction in amplitude of unwanted vibrations of machinery parts through the use of materials of high damping capacity. The problem is to reconcile the requirement for high damping with that for high mechanical quality (strength, fatigue resistance, etc.). Two ways are suggested (1) the use of a material whose decrement generally is low, but rises rapidly as the stress increases; (2) the use of a material whose damping capacity is low, but rises to high peaks in certain frequency ranges. It is shown mathematically in two instances, namely, turbine blade vibrations and crankshaft oscillations in engines, how the suggested methods would work out in practice. C.

**Paints: Accelerated Weathering Tests.** W. Esch. *Kunststoffe*, 1942, 32, 9 (through *Chem. Zentr.*, 1942, i, 2068 and *Chem. Abstr.*, 1943, 37, 6910<sup>8</sup>). A new commercial testing apparatus consists of a 3-kw. arc lamp with special carbons and Corex D glass. It gives illumination equivalent to midday summer sunshine. The sample is rotated around the arc at 48 cm. distance at the rate of one cycle every 2 hours, during which time it is showered with cool water for 15 min. Comparison of this treatment with actual weathering tests shows it to be a reliable accelerated test for paints. C.

**Paint Surfaces: Water Absorption and Pigment Content.** O. E. Hintze. *Fette u. Seifen*, 1942, 49, 332-339 (through *Chem. Abstr.*, 1943, 37, 6910<sup>9</sup>). An exhaustive series of tests was made to determine the relation between swelling of paint films caused by water absorption, amount of pigment present and type of resin employed. Pigment content has a pronounced effect on the swelling of paints containing resins which are chain-type compounds with carbonyl side groups, such as polymers of acrylic acid esters and those of methyl vinyl ketone. The same effect is observed with paints containing polyvinyl acetates, polyvinyl ethers, or cellulose condensed with oxidation products of linoleic or linolenic triglycerides. In general, paints of this type show less swelling as the gloss is decreased. The amount of pigment has little effect on the water absorption of films which contain (1) urea resins or glycerides of fatty acids having conjugated double bonds and which are very flexible, (2) compounds of a decided hydrocarbon character such as polyisobutylene, polystyrene, chlorinated rubber, asphaltic materials, (3) esters of mineral acids such as nitrocellulose or polyvinyl chloride, (4) polymers with carbonyl groups in which the latter are adjacent to a tertiary carbon atom, such as polymethacrylic acid ester. A method for quantitative determination of relative water absorption by paint films is described. Results are presented in tables and graphs. C.

#### (B)—FIRE PREVENTION

**Wood: Fireproofing.** N. C. Jones. *Chemistry and Industry*, 1944, 98-99. A brief account is given of methods of protecting wood against fire by (1) the application of surface coatings, such as oil-base or silicate paints, synthetic resins, alginate or other formulations, and (2) impregnation with fire-retarding chemicals, such as borates, phosphates, chlorides, sulphates, etc. Methods of

testing fire resistance are outlined. Costs of treatment, the effect of fireproofing agents on the strength of glued joints, and the relative efficiencies of different methods of treatment are briefly discussed. C.

**Fire Alarms.** G. W. Underdown. *Power & Works Engineer*, 1943, 38, 276-7. An outline is given of the approved practice for automatic compensating fire alarms which are suitable for large buildings and industrial establishments. La.

(C)—STEAM RAISING AND POWER SUPPLY

**Steam Prime-movers.** C. S. Darling. *Power & Works Engineer*, 1943, 38, 245. It is sometimes possible to avoid the necessity for new power plant by modifying existing plant. Often the use of superheated steam and higher velocities instead of saturated steam will result in lower radiation losses, together with the lower cost of smaller piping and its insulation. Alterations to existing reciprocating engines can produce considerable reduction in the steam consumption and may make the use of higher pressures and temperature possible. Lubrication by injecting pure condensate is another advantageous modification for high temperature working. Turbines can also be modified to produce better and more efficient working. Examples of all these types of improvement are given. La.

**Commutation Troubles.** *Power & Works Engineer*, 1943, 38, 270-274. Reasons behind faulty commutation in d.c. machines are considered in some detail from a fairly elementary point of view. La.

**High-temperature Hot Water Heating: Use in Processing Woollens and Worsteds.** P. Geiringer. *Text. World*, 1943, 93, No. 12, 92-93. Power is obtained by utilising steam at 400-600 lb. pressure in a steam engine or turbine and transforming it into high-temperature hot water (310-320° F.), which is circulated through a closed piping system. It is used for heating rooms and for heating water in storage tanks, which is then mixed with cold water to obtain the correct temperature for process work. The use of hot water coils is suggested for drying machines and dyebaths, and for steaming and conditioning a shallow tray into which the hot water is fed through a liquid level control. W.

(D)—POWER TRANSMISSION

**Driving Belts: Installation, Maintenance and Inspection.** W. J. Roberts. *Practical Engineering*, 1944, 9, 218-219. The author discusses the installation, maintenance and inspection of belts, points out common faults, and outlines precautions which will increase belt life. C.

**Driving Belts: Maintenance.** F. Merish. *Textile World*, 1943, 93, No. 4, 92. Fifteen suggestions for better maintenance of belting are drawn up as the result of a recent survey in American mills. C.

**Small Motors: Selection.** H. Welch. *Machinist*, 1944, 87, 113-115 (American Machinist Reference Book Sheets). A guide for the selection of fractional horse-power motors comprises a table of basic information on available types. The 17 types are grouped in three categories, alternating current, direct current and universal, and for each type the data given include applications, horse-power rating, speeds, permissible over-loads, and reversibility. Characteristic curves and wiring diagrams are also given. C.

**Anti-vibration Mountings.** R. A. Collacott. *Power & Works Engineer*, 1943, 38, 248. Suitable mounting of machinery to avoid vibration is essential if failures due to this cause are to be eliminated. This paper gives a simple treatment of the fundamental ideas about flexible mountings and dampers, showing how they function and why they are effective. La.

**Fluid-flow Meters.** A. Linford. *Power & Works Engineer*, 1943, 38, 253-6. Conditions sometimes occur where the rate of flow is not required and inexpensive metering is essential. Shunt-type meters have been developed for use in such circumstances. They combine the differential-pressure principle with either the rotary-mechanical or float and cone principle and are very efficient in operation. Several types and installations are illustrated and described. La.

**Fluid Couplings.** *Power & Works Engineer*, 1943, 38, 278. Hydraulic couplings are being put to considerable use in auxiliary steam plant. The reasons for their increased popularity in connection with circulating water pumps, boiler-house fans and boiler feed pumps are considered. La.

## (H)—WATER PURIFICATION

**Ion-exchange Resins: Efficiency.** R. J. Myers. *Chem. metall. Engng.*, 1943, 50, 148 (through *Water Pollution Res. Summ. Current Lit.*, 1943, 16, 39). Experimental work on resinous compounds has shown that, unlike gel zeolites, their exchange capacity is not altered with constant use and regeneration. An example is given of the results obtained from the use of Amberlite IR-4 for treating boiler feed water on a commercial scale. Although the raw water contained about 37 g. of salts per gal., treated water after use of the material for about a year contained only 0.5 g. per gal. At first a low exchange capacity was obtained, but when the rate of flow during regeneration was reduced, capacities of 45,000-60,000 g. (as  $\text{CaCO}_3$ ) per cu. ft. were obtained. In another installation comparisons were made of Amberlite IR-1 and a carbonaceous exchange material for treating boiler feed water. The capacity of the Amberlite IR-1 was always greater than that of the carbonaceous material and when the content of salt in the water remained constant it was about double that of the carbonaceous material. Owing to a breakdown in equipment, quantities of mud and alum floc passed into the beds of Amberlite IR-1, and a layer of sediment 3-6 in. deep was deposited on the surface. The beds were partly emptied and the exchange material was washed by decantation. When normal operation was resumed, the exchange capacity returned to its original value. Some uses of synthetic resins are suggested. C.

**Sodium Hexametaphosphate: Use for Corrosion Control.** *J. Amer. Water Works Assoc.*, 1942, 34, 1807 (through *Water Pollution Res. Summ. Current Lit.*, 1943, 16, 39-41). This report of the Committee of the American Water Works Association on Water Conditioning Methods to Inhibit Corrosion includes contributions by various authors on the early use of phosphates in control of corrosion, the theory of the action of hexametaphosphate in holding substances in solution in water and in forming protective films on metals, and the ability of hexametaphosphate to control corrosion. Data obtained from replies to a questionnaire sent to a number of authorities using metaphosphate treatment are presented. Of 168 cities making complete returns 68 reported complete elimination of difficulties, 57 partial or substantial elimination of difficulties, and 9 no improvement by the use of metaphosphate. Details of various experiments are given. The following conclusions are drawn by the Committee. The use of metaphosphate will diminish if not eliminate "red water" and tuberculation in iron pipes, but it is not yet proved that it prevents removal of metal from the surface of the pipe. The effectiveness of metaphosphate in preventing corrosion of non-ferrous metals depends on the metal and the particular aspect of corrosion studied. Abrupt changes in pH value when treatment with metaphosphate is introduced should be avoided in order to prevent sloughing of scale from pipes. When used with lime, metaphosphate prevents deposition of calcium and magnesium salts in a water system, particularly in hot-water coils and piping. Treatment with metaphosphate is more expensive than most other methods used to control corrosion, but other benefits derived from metaphosphate treatment must also be considered. C.

**Sodium Metaphosphate: Use in the Textile Industry.** H. Seymour. *Chem. Age, London*, 1943, 48, 151 (through *Water Pollution Res. Summ. Current Lit.*, 1943, 16, 43-44). The action of metaphosphates in softening water is described. The type most used in the textile industry is sodium hexametaphosphate, which forms the main constituent of "Calgon." A dilute solution of Calgon in water has a pH about 7.2 and sodium carbonate may be added to render the solution more alkaline. Results obtained in America on the use of sodium hexametaphosphate by laundries and textile works are described. C.

**Silica Removal.** W. F. Gerrard. *Power & Works Engineer*, 1943, 38, 281-2. Small quantities of silica in boiler feed water are responsible for a very hard type of scale, and whenever possible this compound should be removed or rendered innocuous. This article explains the action of the silica in conjunction with the other compounds usually found in boiler waters. Methods of dealing with silica fall into three categories: (1) addition of reagents, e.g. phosphates, to the softened water to prevent the residual calcium forming calcium silicate, (2) the use of flocculating agents, e.g. iron, aluminium or magnesium hydroxide, to reduce the silica content by adsorption, (3) treatment to precipitate the silica from solution as an insoluble compound which is removed



from the water with the chalk. The author has been working on the use of magnesium oxide and barium hydroxide in water purification, as an alternative to lime and soda, and it was found that silica was also reduced to an appreciable extent. Careful selection of raw materials and preparation of chemicals is necessary and a new "MW" process has been patented. The boiler is used as the reaction vessel and the specially prepared reagent is introduced either directly when the boiler is out of action or by injection during steaming. Some experience has shown this treatment to be satisfactory both in the prevention of scale and in the removal of old scale, but further experimental work is being carried out.

La.

## PATENT

**Travelling Fan.** Maschinenfabrik Schweizer A.-G. (Horgen, Switzerland) and W. Schweizer. B.P.559,661 of 14/9/1942:29/2/1944. A travelling fan for textile and other machines in which the fan is mounted on a carriage adapted to move backwards and forwards along a track is characterised in that the carriage is provided with two driving rollers rotated in opposite directions from the fan motor and carried by a member so mounted in the carriage that it is capable of oscillating between two limiting positions, in which one or other of the driving rollers, as the case may be, is engaged with the track, control means being provided at each end of the track to move the member from one limiting position to the other to reverse the direction of movement of the carriage. C.

## 9—PURE SCIENCE

**Cotton Leaf: Hydration and Potash Supply.** E. Phillis and T. G. Mason. *Annals of Botany*, 1943, New series, 7, 391-397. Cotton plants were grown with varying K supply under wet and dry conditions. Dry weight of the whole plant, hydration in the leaf and in the bark (in terms of dry weight and of protein), and the specific conductivity of leaf and bark sap were determined. It was found under both wet and dry conditions that, so long as they caused little or no further increases in dry weight, increases in K supply caused increased hydration and increased sap concentration. Thus the effect of K on hydration falls into line with the salt concentration hypothesis of hydration. Size of plant *per se* affects the hydration of the leaves under dry conditions. It also affects the hydration under wet conditions as the plants age, possibly as a result of an increase in resistance to the movement of water within the plant. Hydration in the bark undergoes very similar changes to those in the lamina in response to changes in potassium supply. C.

**Cotton Plant; Partition of Mineral Elements in —.** T. G. Mason and E. Phillis. *Annals of Botany*, 1943, New series, 7, 399-408. The relation between crystalloid-N and protein-N has been investigated in an experiment in which N supply was varied from acute starvation to considerable excess. The crystalloid-N concentration (in terms of dry weight) rose continuously with increasing supply, whilst the protein concentration rose to a maximum value and then declined. The relation between crystalloid-N and protein-N follows an adsorption (apolar) pattern. In a second experiment, P supply was varied from acute starvation to excess. The concentrations of both sap-soluble and insoluble P rose continuously with increasing supply. It had been anticipated from previous experiments that insoluble P would decline as the P supply reached high levels, but no such decline was noted. The data of this and of previous experiments considered together are in harmony with the view that the relation between soluble and insoluble P is of the same type as that between crystalloid-N and protein-N. The relation between crystalloid-N and protein-N remains relatively constant from experiment to experiment in spite of widely divergent conditions, but the soluble/insoluble P relation changes markedly from experiment to experiment. Most of the N in the leaf is present in organic form, whilst much of the P is present as phosphates. The relation between starch and sugar is controlled by factors quite unlike those that prevail for N and P. C.

**Cotton Plant: Colchicine Treatment.** K. C. Amin. *Indian Farming*, 1943, 4, 257-258. The application of colchicine induces artificial doubling of chromosomes. As normal growth continues after the influence of the drug is withdrawn, the tissues formed from the treated cells all contain double the



normal chromosome number. A very dilute solution of colchicine is used for soaking seeds, and for treating germinated seeds and growing shoots of plants. Doubling the chromosomes results in abnormal swelling of the hypocotyls, thickening of leaves and increase in floral parts. In cotton, there often occurs an increase in the length of the fibre (with thickening also in some cases) and in the size of seeds. Hybrids between Asiatic cottons which have 26 and cultivated American cottons which have 52 chromosomes in the vegetative cells generally prove to be self-sterile. Only stray and infrequent setting of seeds can be obtained from backcrossing these hybrids to American parents. By the use of colchicine such sterile hybrids can be made to show good setting of seeds. Chromosome doubling in pure types results in self-sterility. Doubled Asiatic cottons cross freely with American cottons. Colchicine treatment is being used in the production of new cottons from various wild types, e.g. a hybrid between a wild African and a wild American species, having 26 somatic chromosomes each, which without colchine treatment give a completely sterile hybrid. C.

**Cotton Hybrids: Vigour.** D. Ganesan. *Indian J. Genet. Pl. Breed.*, 1942, 2, 134-150 (through *Plant Breed. Abstr.*, 1944, 14, 13). The manifestation of hybrid vigour has been examined in intraspecific hybrids of *Gossypium arboreum* var. *neglectum*. It is necessary to eliminate environmental and maternal influences and this is possible by means of suitable field methods and the use of reciprocal crosses. The conclusion is drawn that seed weight by itself gives ample evidence of the manifestation of hybrid vigour in the seed, and is a good index in forecasting hybrid vigour in the post-germination period. The author discusses his results in the light of the concept of "initial advantage" which he extends to cover a more general range of observations. C.

**Cotton Plant: Genetics.** *Progress Rept. Cotton Genetics Research Scheme, Indore*, 1941-42, 31 pp. (through *Plant Breed. Abstr.*, 1944, 14, 11-12). The genetical relationships of the various genes determining lintless seeds have been investigated. Crosses between 1027 lintless (*lia*) and Wagad lintless (*lib*), Punjab hairy lintless (*lic*) and 1027 lintless (*lia*), Wagad lintless (*lib*) × Punjab hairy lintless (*lic*), Wagad lintless (*lib*) and *G. arboreum* varieties, Nandyal lintless and Narrow Kokati, and Punjab hairy lintless (*lic*) and Punjab glabrous lintless (*lib*) have been studied. The conclusion is reached that *lia* and *lic* are distinct genes with *lic* epistatic to *lia*; a modifying gene is postulated to determine lint production in the presence of either *Lia* or *Lic*. No linkage could be found between *lia* and either petal colour (*Y*) or anthocyanin (*R<sub>2</sub>*) genes. Neither anthocyanin, flower colour or leaf shape genes exhibited linkage with *lib*. It appears that *lic* and *hb* are distinct genes. The gene *R<sub>2</sub><sup>cs</sup>* is distinguished from gene *R<sub>2</sub><sup>os</sup>* by the anther pigmentation of its phenotype. Allelic intermutation is reported for the *R<sub>2</sub>* series. A gene determining "pale yellow petal" (*Y<sub>p</sub>b*) occurring in a Chinese introduction is different from the Banilla pale yellow gene (*Y<sub>p</sub>a*). Fuzz inheritance is apparently more complex than generally supposed and the evidence suggests that several genes are probably involved. The genetics of wilt resistance has been studied in the varieties New Million Dollar, and Jarila, seed has been obtained from various interspecific hybrids, bolls have been set in colchicine treated plants of *G. Taitense* × *G. hirsutum* and *G. Armourianum* × *G. hirsutum*, and heterosis has been observed in *G. arboreum* crosses. Statistical analysis has shown that little further improvement of ginning percentage or halo length is to be expected by continuous selection. The relative efficiencies of various sampling patterns have been investigated. C.

**Cotton Plant: Genetics.** *Progress Rept. Cotton Genetics Research Scheme, Indore*, 1942-43, 20 pp. (through *Plant Breed. Abstr.*, 1944, 14, 12-13). A few instances of simple dominance of naked seeds to fuzzy have been observed but, in general, the progeny of crosses between these two types show continuous segregation for this character, several of the intermediate grades breeding true. It is assumed that fuzziness is determined by multiple factors. Crosses between 5-locular and 3-locular bolls have demonstrated that the former are simply recessive to the latter. The character "red leaf" which exhibits a practically uniform red pigmentation on the upper leaf surface must be distinguished from "patchy red leaf" which is probably caused by jassid infection. "Red leaf" is determined genetically and when crossed with normal types gives an *F<sub>2</sub>* segregation of red, intermediate and normal green forms in ratio of 1:2:1. "Green spotless" (*R<sub>2</sub><sup>oo</sup>*) is the basic recessive allele of the *R<sub>2</sub>* series. It

segregates according to a 3:1 ratio when crossed with  $R_2^{os}$ . A single plant of Upland cotton, whose seed had received a 20 min. X-ray treatment, behaved outstandingly in progeny trials; it was superior to M.V. 4 in yield, ginning percentage and lint length. A wilt-resistant strain of Malvi is not yet homozygous and several wilt-resistant families have been found among the progeny of the following crosses: M'  $\times$  Jarila, M-9-20  $\times$  Jarila and Million Dollar  $\times$  Jarila. *G. anomalum* is very susceptible to wilt and this defect was conveyed to all the progeny of the cross  $4n$  (*G. anomalum*  $\times$  K<sup>9</sup>)  $\times$  *G. hirsutum*. Crosses between Bengal strains and varieties of *G. arboreum* exhibited heterosis for several quality characters. The correlation between earliness and various morphological features has been investigated and a statistical analysis made of the various components of yield. Regression coefficients were calculated between the number of bolls per plant, the number of seeds per boll, the weight of cotton per seed and the ginning percentage. The conclusion was drawn that the most important character to select is the weight of cotton per seed. C.

**Punjab Hairy Lintless Cotton Mutant.** K. Ramiah and S. R. Kaiwar. *Indian J. Genet. Pl. Breed.*, 1942, 2, 98-110 (through *Plant Breed. Abstr.*, 1944, 14, 13). The multiple effects of the gene pair *Lic, lic* have been investigated with reference to the following characters: total height, internodal length, number of nodes, growth rate, development of the testa, leaf shape, boll and seed characters and seed viability. The conclusion is reached that the mode of action of the genes considered is a genuine case of pleiotropism. C.

**Atmospheric Ozone Concentration Recorder.** E. Gluckauf, H. G. Heal, G. R. Martin and F. A. Paneth. *J. Chem. Soc.*, 1944, 1-4. Diagrams and a detailed description are given of a semi-portable apparatus for the continuous recording, over periods up to 24 hours, of the local concentration of atmospheric ozone. The principle of the method is the liberation of iodine from buffered potassium iodide solution, and its electrometric titration at short intervals with very dilute sodium thiosulphate solution. The small current resulting from the depolarisation of a pair of platinum electrodes by the iodine is amplified by a two-stage valve amplifier, and made to actuate the automatic burette, containing the thiosulphate solution, when the iodine concentration reaches a given value. C.

**Boron: Detection.** J. A. Radley. *Analyst*, 1944, 69, 47-48. A portion of test solution, previously made slightly alkaline with N-sodium hydroxide, is evaporated to dryness, the residue is taken up in 0.1 ml. of water and again evaporated on a watch glass, and two drops of a reagent made by dissolving 0.5 g. of the unsulphonated base of Solway Purple (Colour Index No. 1073) in 100 ml. of concentrated sulphuric acid are added. The development of an intense deep blue colour indicates boron. Oxidising agents, especially nitrates, interfere and should be removed by adding one drop of concentrated sulphuric acid and a crystal of hydrazine sulphate to the spot and evaporating to dryness. In the presence of fluorides the blue colour takes 2 or 3 min. to develop and a drop of the reagent should be put at the side for comparison. Fluorides may be removed by heating the spot with two drops of concentrated sulphuric acid and a little silicic acid prior to adding the reagent. In the absence of fluorides 0.1 ml. of test solution containing 1 g. of hydrated borax in 100 l. of water gives the reaction. Another test for boron depends on the production of an intense orange brown fluorescence in daylight on addition of a 0.01 per cent. solution of 1-amino-4-hydroxyanthraquinone in concentrated sulphuric acid. To one drop of the test solution in a small test-tube add 1 ml. of the reagent and examine against a black velvet background. One drop of a solution containing 1 g. of hydrated borax in 10 l. is the limit of detection by this method. C.

**Iodine: Amperometric Titration. Water: Dissolved Oxygen Test.** D. P. Evans and N. T. Simmons. *J. Soc. Chem. Ind.*, 1944, 63, 29-30. A study of the application of Foulk and Bawden's dead-stop end-point in iodometry has shown that a minimum concentration of 0.2 per cent. K iodide is necessary to maintain the platinum anode depolarised throughout the titration. 1 ml. of 0.002N. thiosulphate dissolved in 250 ml. of acidulated water then requires a titre of  $1.00 \pm 0.01$  ml. of 0.002N. iodine. The errors obtained if less than 0.2 per cent. K iodide is used are described and explained. When this method is employed for determining dissolved oxygen in de-aerated water, the results

should be obtained with an error of  $\pm 0.0005$  ml. of oxygen per litre. Details are given of a simple, expeditious and accurate procedure. C.

**Methylene Blue: Determination.** G. J. W. Ferrey. *Quart. J. Pharm.*, 1943, 16, 208-212 (through *Analyst*, 1944, 69, 54-55). Methylene blue can be precipitated with potassium dichromate as tetramethylthionine dichromate,  $(C_{16}H_{18}N_3S)_2 \cdot Cr_2O_7$ , which is very nearly insoluble in water or dilute acetic acid containing a moderate excess of dichromate, but is slightly soluble in the presence of sodium acetate. The precipitate has a composition independent, within wide limits, of the excess of reagent, and, since a stable reagent is used, this method is more convenient than the titanous chloride method. Details of volumetric and gravimetric procedures are given. The volumetric method is applicable to the assay of methylene blue or to its determination in tablets and pills. Acacia, dextrin, starch, lactose, dextrose or sucrose do not interfere, provided that the precipitation is carried out in the cold. In the presence of starch the substance is dissolved in boiling water and the solution is cooled to room temperature prior to the precipitation. The dye can be extracted from insoluble vegetable excipients, e.g. gentian, liquorice or marshmallow, by boiling with successive small quantities of 10 per cent. acetic acid and decanting through a plug of cotton wool or glass wool; the error introduced will not be greater than 2 per cent. Where greater accuracy is required or in the presence of hexamine, which vitiates the volumetric procedure, the gravimetric method should be applied. C.

**Lily Bulb Starch: Extraction and Properties.** N. W. Stuart and B. Brimhall. *Cereal Chemistry*, 1943, 20, 734-739. The extraction of starch from bulbs of the Easter lily, *Lilium longiflorum* Thunb., is described and the properties of the starch are discussed and compared with those of other starches. Lily bulb starch resembles potato starch in granule size, gelatinization temperature, and X-ray pattern, but the properties of its pastes (appearance, consistency, and variation with temperature) are more nearly like those of corn starch. By the potentiometric iodine titration method, lily bulb starch was found to have the largest proportion of unbranched molecules (30 to 34 per cent.) of any native starch so far examined. C.

**Fat and Fatty Acid Anti-oxidants: Testing.** A. Banks. *J. Soc. Chem. Ind.*, 1944, 63, 8-13. The rapid oxidation resulting from the addition of small quantities of haematin to suspensions of linoleic acid in buffered 2 per cent. starch solution can be measured by using the Warburg or Barcroft technique at 30° C., and this procedure has been adopted for the rapid testing of anti-oxidants. Evidence is produced to show that the initial stage of the oxidation is not catalysed by the haematin. The results of tests, therefore, refer to the action of anti-oxidants on the spontaneous oxidation of suspensions of linoleic acid at 30°. Numerous substances have been tested, and certain dried flower petals, logwood extract, haematoxylin, haematin, brazilin, and the usual anti-oxidants have been found to be active. Preliminary tests have shown that compounds containing a carboxyl, keto-, or  $R \cdot CH(OH)$  group are not good anti-oxidants. Pyrocatechol and its derivatives are much more active than quinol, and  $\alpha$ -naphthol and 1:5-dihydroxynaphthalene are good anti-oxidants, but  $\beta$ -naphthol seems to have slight pro-oxygenic properties. The importance of the physical state of the fat or fatty acid during oxidation is briefly discussed. C.

**Polyvinyl Alcohol: Chemistry and Applications.** I. Jones. *British Plastics*, 1943, 15, 380-384, 408; 1944, 16, 77-83, 122-129. A review of the preparation and properties of polyvinyl alcohol, the reactions of this compound, particularly reactions with aldehydes and ketones to give resins of the polyvinyl acetal type, and processes for the insolubilization of polyvinyl alcohol by (1) partial conversion into some insoluble derivative such as the formal, (2) formation of insoluble complexes with certain inorganic compounds, such as boric acid and borax, chromium compounds, and cuprammonium hydroxide, and (3) formation of cross-linked derivatives with carboxylic acids, polyhalogenated compounds, dialdehydes, water-soluble thermo-setting resins, or diisocyanates or di-isothiocyanates. Plasticizers are mentioned and methods of forming articles from polyvinyl alcohol plastics are described. Applications are discussed. C.

**Cetyl Acetate/Water Interface: Ionic Adsorption.** W. Dickinson. *Trans. Faraday Soc.*, 1944, 40, 48-59. An attempt is made to correlate the electro-

kinetic behaviour of the cetyl acetate/water interface as influenced by K chloride, iodide and thiocyanate with the effects produced by these salts upon the interfacial tension. The treatment is based on a combination of fixed and diffuse electrical double layers on the one hand and the Gibbs adsorption isotherm on the other. On this basis separate anion and cation adsorptions for each salt have been calculated for the fixed as well as the mobile portions of the total double-layer region. Iodide and thiocyanate ions exhibit marked positive adsorption over the whole range of concentration investigated. The chloride ion in the most dilute range shows a slight positive adsorption which later becomes negative. The K ion from the iodide and chloride shows negative adsorption over the range of concentration investigated. For the thiocyanate the K ion surface excess is approximately zero over the whole concentration range. C.

**Mineral Oil-Polar Compound Mixtures: Oil/Water Interface.** R. G. Aickin. *J. Soc. Dyers & Col.*, 1944, 60, 41-43. The interfacial tensions of mixtures of mineral oil and polar compounds (oleic acid, oleyl alcohol, and glycerol mono-oleate) have been measured. From the results the packing of the polar compounds at the oil/water interface has been determined. A stable 1:1 mineral oil-polar compound complex is present in the interface over a wide range of concentrations, regardless of the interfacial tension of the system. The presence of this complex provides the basis of a simple mechanistic picture of the great stability of emulsions stabilised by mixtures of oil-soluble and water-soluble polar compounds, e.g. mixtures of higher alcohols and sodium alkyl sulphate. The addition of glycerol mono-oleate reduces the interfacial tension of mineral oil against water to an extremely low figure, and it is effective in extremely low concentrations. Solutions of glycerol mono-oleate in mineral oil are micellar in nature; this is one of the few cases reported of the formation of micelles in hydrocarbon systems. C.

**Protein Solutions: Viscosity and Flow Birefringence.** A. S. C. Lawrence, J. Needham and S. Shen. *J. Gen. Physiol.*, 1944, 27, 201-232. The viscosity and flow birefringence of colloidal solutions are discussed in relation to the size, shape and orientation of the particles. Diagrams and a detailed description are given of a coaxial viscometer of the Couette type in which provision is made for simultaneous measurements of flow-birefringence and viscosity. The results of measurements on dilute solutions of proteins, and the conditions under which the coaxial viscometer measures the viscosity of the bulk phase and the surface film phase respectively are discussed. The general behaviour of protein solutions subjected to shear is summarised. C.

**Protein Solutions: Viscosity and Flow Birefringence.** A. S. C. Lawrence, Margaret Miall, J. Needham and S. Shen. *J. Gen. Physiol.*, 1944, 27, 233-271. A report is given of an extensive investigation of protein particle shape by the methods of flow-birefringence and anomalous viscosity measurement in the coaxial cell. From the results the conclusion is reached that proteins may be divided into four groups. Group A comprises proteins which show flow-anomaly both in the bulk phase and in the surface film, and flow-birefringence in the bulk phase. Examples are tobacco mosaic disease virus nucleoprotein and myosin. Though corpuscular proteins, they have elongated particles before denaturation. Group B consists of proteins showing flow-anomaly only (in the first instance) in the surface film, and no flow-birefringence in the bulk phase. The particles are probably close to spherical in shape in solution, but become elongated as they denature in the surface film. After this process has been completed, the proteins may show flow-anomaly also in the bulk phase. Some proteins (Group B<sub>1</sub>, e.g. serum euglobulin and amphibian embryo euglobulin b) show flow-anomaly in the surface film immediately it forms, others (Group B<sub>2</sub>, e.g. avian ovalbumin), only show it after a certain time has elapsed for the building up of the film. Group C consists of proteins which show flow-anomaly neither in the bulk phase nor in the surface film, under the conditions used by the authors. They are probably close to spherical in shape, and the group includes insulin, methaemoglobin and mucoproteins. The theoretical significance of protein fibre molecules, whether native or formed by denaturation in the living cell, is discussed, especially in relation to experimental morphology and cytology. C.

**Dichromat Observers: Colour Mixture and Wave Length Discrimination.** G. A. Fry. *J. Optical Soc. America*, 1943, 33, 682. When matches for the spectral colours are determined by dichromats by mixing two primaries at the red and blue ends of the spectrum, the energy ratios required for the matches can be expressed in terms of the equation  $\log R_E = K(\lambda - C)$ , where  $R_E$  represents the energy ratio of the two primaries,  $\lambda$  the wave length, and  $K$  and  $C$  are constants. The value of  $K$  remains relatively constant from one dichromat to another. The  $C$  value for the protanope is lower than that for the deuteranope, and the difference cannot be attributed to the protanope's reduced brightness response for wave lengths at the red end of the spectrum; it has to be accounted for in terms of valence relationships between the primaries. The relative valence of two stimuli has been arbitrarily defined by assuming that the two stimuli have equal valence when there are just as many "just noticeable difference" steps from a half-and-half mixture to one pure component as to the other pure component. Wave length discrimination data have been used to determine the energy ratio of the two primaries required to produce equal valence. When the energy ratio for the two primaries is adjusted to give them equal valence it is found that an approximately linear relationship exists between the "just noticeable difference" steps and the percentage of yellow or blue in the di-stimulus matches for the various wave lengths. The above formula for colour mixture data for dichromats can be used in determining the di-stimulus matches for various heterochromatic stimuli. This procedure can be applied in connection with the determination of confusion colours for dichromats. C.

**Lovibond Tintometer: Development.** G. S. Fawcett. *Proc. Phys. Soc.*, 1944, 56, 8-21. A discussion of the development of the Lovibond Tintometer, the principles of the C.I.E. (Commission Internationale d'Eclairage) system of colour measurement and the conversion of Lovibond and other colour readings to C.I.E. units, and recent modifications and uses of the Tintometer. C.

**Yellow Glass Colour-temperature Filter: Construction and Use.** H. G. W. Harding. *Proc. Phys. Soc.*, 1944, 56, 21-30. A yellow glass filter for use in measurements of the colour temperature of lamps, by means of standard lamps that operate at lower colour temperatures, is made from Corning 346 and 507 glasses. Notes are given on the methods of construction and use. Colour temperature measurements made with this glass filter agree to  $4^\circ$  K. with measurements obtained with a blue liquid filter previously used in the laboratory. The advantages of the yellow filter over the blue filter are pointed out. C.

**Experimental Fluid Dynamics: Application to Engineering Problems.** G. A. Hankins. *Engineering*, 1944, 157, 158-160, 177-180. A report of a lecture on the possibilities of extending to other engineering problems the experimental methods of fluid dynamics developed in wind-tunnel and ship-tank researches. The basic principles of dynamical similarity and dimensional analysis are developed and their importance is emphasised. The Reynolds, Froude and Mach numbers are explained. C.

**Clean Metal Surfaces: Stick-Slip Motion.** J. B. Sanupson, F. Morgan, D. W. Reed and M. Muskat. *J. Applied Physics*, 1943, 14, 689-700. A comparative study has been made of the motion during the slip of slip-stick motion for a number of combinations of unlubricated metals. The variation of friction with velocity was determined for several typical cases. Details of the apparatus and procedure are given. The results show that sliding friction between metals drops from a higher static to a lower kinetic value, usually abruptly. The kinetic friction remains fairly constant but shows a slow decrease as time passes, and does not instantaneously increase to the static value when the surfaces come to rest. Therefore, a simple, reversible friction-velocity relation does not exist and the friction depends rather on the history of the motion. These results support the view that plasticity, adhesion, and shearing actions are involved in sliding friction of unlubricated surfaces. C.

**Rheological Constants: Evaluation from Tensile and Compressive Tests.** W. Lethersich. *J. Sci. Instruments*, 1944, 21, 27-31. A formula is derived by which tensile stress may be related to shearing stress in compression or extension experiments. A relation is, however, only obtainable for certain types of materials, principally incompressible ones. The formula is extended to large

strains, which leads to a new definition of strain and of Poisson's ratio. It is also shown that if the tensile force is constant, suitable correction may be made for the change of stress due to change of cross-sectional area. Examples are given of the application of corrected equations to Newtonian fluids, ideal elastic solids, solids with elastic after-effect (relaxation time), but no plastic flow, visco-elastic materials, and materials obeying the Scott-Blair power law. C.

**Polystyrene: Apparent Second-order Transition Point.** T. Alfrey, G. Goldfinger and H. Mark. *J. Applied Physics*, 1943, 14, 700-705. At temperatures above 80° C. the specific volume of polystyrene is an explicit function of the temperature;  $dV/dT = 0.00043$ . At temperatures below 40° C. the specific volume of polystyrene depends upon its past thermal history;  $dV/dT = 0.00024$ , although  $V$  is not explicitly fixed by the temperature alone. When a sample of polystyrene is cooled at constant rate, it contracts according to the higher expansion coefficient until some critical region of temperature, and then contracts according to the smaller coefficient. The position of the critical temperature region depends upon the rate of cooling. The faster the cooling, the higher the transition point. In the intermediate temperature range (40-80° C.), complex time effects can be observed. A sample heated from 20° C. to this intermediate range will first expand, according to the small expansion coefficient, and then contract slowly toward a smaller volume. The rate of this contraction is greater at higher temperatures. All these observations are in fair accord with the interpretation of the second-order transition point of polystyrene as the temperature at which rate of volume change becomes comparable with the experimental time scale. C.

**Natural and Synthetic Rubber: Filler Reinforcement.** J. Rehner, Jr. *J. Applied Physics*, 1943, 14, 638-645. An attempt is made to develop a general theory of filler reinforcement by determining the stresses occurring in and about a spherical particle imbedded in a rubber-like medium subjected to an applied tension. For a system containing a single particle rigidly attached to the adjacent medium, an application of the theory of elasticity shows that, for infinitesimal deformations, the stress components within the particle are independent of the radial distance from the origin, taken at the centre of the particle. The stress components at a given point in the surrounding medium depend on the elastic constants both of the particle and of the medium, on the radius of the sphere, on the distance from the origin, and on the angle between the direction vector and the applied tension. Expressions are given for the average stresses in media containing many (independent) particles. Theoretical values of the bulk moduli of the synthetic rubbers considered in the treatment are derived from sound velocity data. Curves showing the spatial distribution of radial and shear stresses are presented for a range of values of elastic constants to be expected for different kinds of filler particles and rubber-like materials. C.

**Rubber-like Materials: Effect of Temperature on Mechanical Properties.** W. P. Fletcher. *Nature*, 1944, 153, 341-342. Using a mechanical vibrator working at 20-60 c.p.s., the author has made measurements of dynamic elastic compression modulus and associated resilience of natural and synthetic rubbers by the well-known resonance method. Curves are given showing the variation with temperature of the relative dynamic modulus (modulus at the stated temperature divided by modulus at some standard temperature), for Neoprene E (chloroprene polymer), GR-S (butadiene-styrene co-polymer) and natural rubber compounds. Attention is called to the following facts in connexion with rubber-like materials for use in anti-vibration devices. (1) The dynamic modulus has a considerable temperature coefficient. (2) Quite apart from temperature variations likely to be encountered in service, this fact is of importance in the quoting of dynamic results. The temperature of test should always be stated. (3) No sign of a temperature effect of this order is evident from static loading tests. (4) In view of these facts, the practice of specifying the low-temperature requirements of such products as instrument mountings (anti-vibration) in terms of a static test is likely to lead to wastage of raw materials and labour and the production of articles quite unsuitable for their intended purpose. C.

**Cellulose-dextrin Culture Medium: Preparation and Use.** W. H. Fuller and A. G. Norman. *Proc. Soil. Sci. Soc. Amer.*, 1942, 7, 243-246 (through *Chem. Abstr.*, 1943, 37, 6691<sup>a</sup>). A method is described for the preparation of cellulose-

dextrins by cold acid hydrolysis of cellulose. The insoluble dextrins of mean chain lengths varying from 75 to 25 anhydroglucose units are suitable in agar media for the growth of cellulose organisms. Insoluble dextrins on incorporation into agar give an opalescent medium on which the more active cellulose-decomposing organisms, including *Cytophagas*, develop as restricted colonies surrounded by a partially cleared zone. The optimum dextrin concentration is 0.1 per cent. This medium can be used for the isolation and purification of cellulose bacteria, and for the direct enumeration of cellulose organisms in soil suspensions. The soluble dextrins support a more luxuriant growth of the cellulose bacteria, but are not used by the specialised forms. Loss of cellulose-decomposing ability is less rapid on this medium than on starch. C.

**Silkworm: Water, Dry Substance and Nitrogen Contents.** N. S. Dem'yanovskaya and A. V. Sokol'skaya. *Biokhimiya*, 1943, 8, 77-84 (through *Chem. Abstr.*, 1943, 37, 67487). The character of changes of water, dry substance and total nitrogen in the bodies of caterpillars, pupae and adults of *Antheraea pernyi* G. in the course of development is generally analogous to that found for *Bombyx mori*. Pupae of caterpillars of the spring generation contain more water and nitrogen than those of the summer-autumn generation. The difference is probably due to chemical difference in the leaves at the different periods of the year. C.

**Micro-volumetric Analysis Apparatus.** G. H. Wyatt. *Analyst*, 1944, 69, 81-89. A review of micro-volumetric apparatus, including measuring flasks, pipettes, burettes and titration vessels. Diagrams are given. C.

**Amino Acids: Chromatographic Separation.** G. Schramm and J. Primosigh. *Ber. deut. chem. Ges.*, 1943, 76 B, 373-386 (through *Chem. Abstr.*, 1943, 37, 65167). The authors describe a method of separating neutral amino acids from one another by chromatographic adsorption on activated charcoal and on aluminium oxide in the presence of formaldehyde. With a charcoal column which had been washed with 5 per cent. acetic acid, it was found that glycine, alanine, serine, proline, methionine, valine, leucine, isoleucine added to the column and eluted with 5 per cent. acetic acid passed completely into the first eluate, whereas phenylalanine, tyrosine and tryptophan were adsorbed. These acids can be completely eluted with 5 per cent. phenol in 20 per cent. acetic acid at room temperature. In acid hydrolyzates of protein, where tryptophan is completely and tyrosine partly destroyed and only phenylalanine can be determined, it suffices to elute the latter with hot 20 per cent. acetic acid and to determine it colorimetrically. Cystine can also be separated quantitatively from aromatic amino acids under similar conditions. The adsorption on charcoal is apolar and is greatly influenced by structural properties. Separation of aliphatic amino acids from one another by chromatography on charcoal has not been wholly satisfactory as yet. The separation is best effected with aluminium oxide by the formaldehyde method. Adsorption on aluminium oxide after it has been treated with acids is anionotropic, and therefore acid amino acids can be adsorbed, but not basic or neutral acids. Neutral amino acids in the presence of formaldehyde behave as acids as regards adsorption on the anionotropic aluminium oxide column. Glycine and serine in 10 per cent. or more formaldehyde are firmly adsorbed, whilst alanine, valine, leucine and proline are not. C.

**Starch-syrup Colloids: Determination.** P. I. Zubov. *Trudy Voronezh. Khim.-Tech. Inst.*, 1940, 5-6, 62-77 (through *Khim. Referat. Zhur.*, 1941, 4, No. 6, 127 and *Chem. Abstr.*, 1943, 37, 69267). In an investigation of the coagulation of starch-syrup colloids by mixtures of alcohol and ether a method has been developed for their gravimetric determination. To each c.c. of a 5-10 per cent. aqueous solution of syrup acidified with hydrochloric acid to pH less than 3 add 34 c.c. of 96 per cent. alcohol, then 5 c.c. of ether, filter after 5-10 min., wash the precipitate with the alcohol-ether mixture and dry the washed precipitate to constant weight at 100-105°. The total time required for the determination is 6-7 hours. The method is accurate. A similar rapid method for determining colloids is proposed by which the precipitate after filtering and washing is dried rapidly, peptized with water and analysed refractometrically with an immersion refractometer. The density of the colloidal substance in syrup was 1.52 and the colloidal particles were positively charged. Data of laboratory and plant experiments in determinations of the content of colloids



in the hydrolysis process of starch are given. The hydrolysis process of starch is identical in all cases regardless of the concentration of the solution, and the reversion products possess no colloidal properties. C.

**Tannin: Micro-determination.** (1) M. Nierenstein. (2) C. A. Mitchell. *Analyst*, 1944, 69, 91, 92. (1) For the determination of tannin leaves are dried at 100° C., powdered and extracted for 1 hour in a Soxhlet extractor with a mixture of chloroform and carbon tetrachloride (to extract chlorophyll, waxes, etc.). Adhering solvents are then evaporated and the leaf powder is extracted with boiling water for 25-30 min. in a Soxhlet apparatus. Strips of thin cardboard which have been soaked in a 1 per cent. solution of white gelatin and dried are immersed in the cold tannin solution for 24 hours, dried, and stained for 24 hours with a 1 per cent. solution of anhydrous ferric ammonium oxalate, and dried. The strips are then matched against standards prepared by immersing similar gelatin-treated strips in solutions containing 0.25-0.1 mg. of Mitchell's glucose-free gallotannin, drying and staining with a 1 per cent. solution of anhydrous ferric ammonium oxalate. (2) The composition of the glucose-free gallotannin (derived from Chinese galls) used as standard in the above test is discussed. It is pointed out that natural tannins are not uniform products and that the only component in the constitution of natural tannins that can be looked upon as fundamental is the pyrogalllic grouping, and it should be possible to standardise tannins on that basis. Since Nierenstein has made the exceptional glucose-free tannin the standard for his test, the simplest plan would be to standardise other tannins against it. This could be done by estimating the total pyrogalllic groups in terms of gallic acid, determining and deducting the pyrogalllic groups due to the gallic acid, and multiplying the difference by the empirical factor 2.2. Another method of making the Nierenstein standards generally available would be to use Lovibond glasses corresponding with the respective colours in the scale. The Lovibond units corresponding to the colours of standards ranging from 1 mg. to 0.25 mg. of glucose-free tannin are indicated. C.

**Valine and Arginine: Microbiological Determination.** J. R. McMahan and E. E. Snell. *J. Biol. Chem.*, 1944, 152, 83-95. A medium and procedure are described for the determination of valine and arginine in protein hydrolysates, based upon their response to the growth of *Lactobacillus casei* and *L. arabinosus*. The method is accurate, applicable to the detection of minute amounts of amino-acids, and does not require extensive pre-treatment of the protein hydrolysate. Results of determinations of the valine and arginine contents of casein, ovalbumin, silk fibroin, horse hemoglobin, lactoglobulin and gelatin are given. Silk fibroin yields 3.2 per cent. of valine and 0.97 per cent. of arginine. By suitable modification of the basal medium, and the use of a number of organisms, the procedure becomes applicable to the determination of several amino acids besides valine and arginine. Possible variations and applications of the technique are briefly discussed. C.

**Cellulose: Reaction with Formaldehyde.** H. Dillenius. *Kunstseide u. Zellwolle*, 1942, 24, 520-533 (through *Chem. Abstr.*, 1943, 37, 6889<sup>3</sup>). Increasing amounts of formaldehyde can be introduced into cellulose hydrate by decreasing pH, increasing acid-catalyst concentration or increasing formaldehyde concentration. The last method causes the least degradation of cellulose hydrate. Thus, starting with cellulose hydrate of a degree of polymerization (DP) of 286 and introducing sufficient formaldehyde (0.4-0.7 per cent.) to reduce the alkali solubility from 28 per cent. to 3 per cent., the following final DPs were obtained by the three methods: 85, 125, 209. Although the chain length of cellulose hydrate is reduced by oxidation during the formaldehyde reaction, the strength of the fibre is unaltered. By starting with degraded fibres of low molecular weight the strength can be materially increased. The reaction serves to increase greatly the chemical resistance of the fibres. These effects can be explained only by the assumption that different cellulose hydrate chains are linked together with formaldehyde through methylene bridges. C.

**Cellulose: Solubility.** A. Marschall. *Kunstseide u. Zellwolle*, 1942, 24, 462-475 (through *Chem. Abstr.*, 1943, 37, 6887<sup>3</sup>). An attempt was made to clarify the behaviour of native and regenerated cellulose toward 10 per cent. caustic soda solution, saturated calcium thiocyanate, sodium zincate and formic acid-calcium chloride, the last three solvents having the capacity of quantitatively separating



regenerated from native cellulose. Native cellulose was subjected to the following controlled chemical degradation reactions: hydrolysis with mineral acids, oxidation with hydrogen peroxide and K dichromate-sulphuric acid, alkali ripening, acetolysis, mechanical degradation by severe beating and precipitation of cellulose acetate solutions. Degradation products still retaining the fibrous structure of native cellulose show only 10-20 per cent. solubility in formic acid calcium chloride and mostly complete solubility in calcium thiocyanate and sodium zincate solutions. Solubility in caustic soda solution varies with the type of chemical degradation; it is appreciable with oxidising reactions, but may be only 5-6 per cent. when the hydrolysis is to a degree of polymerization of 250. The solvent mixture formic acid-calcium (or zinc) chloride was found to be the most suitable of any yet tested for differentiating native from even the most degraded cellulose products. Mechanical degradation of native cellulose leads to complete solubility in formic acid-calcium chloride solution even at a DP of 655. Alkali solubility is also higher than for the corresponding hydrolysed products. Cellulose regenerated from the triacetate, still retaining the fibrous structure, gave increased solubility in caustic soda and formic acid-zinc chloride solutions. The author did not succeed in duplicating the properties of regenerated cellulose in a product obtained by chemical degradation of native cellulose. This, with the possible exception of mechanical beating, can be obtained only through solution of native cellulose. C.

**Cupriethylenediamine Cellulose Solvent: Nature.** R. M. Levy and P. Muffat. *Paper Trade J.*, 1944, 118, *TAPPI*, 40-44. Previous work on the nature of cupriethylenediamine and its reactions with cellulose are reviewed, and an account is given of spectrophotometric and electrometric studies, the preparation and examination of solid cupriethylenediamine complexes, and a study of the reaction of the diamine with cellulose. The results lead to the following conclusions: (1) The dissolution of cellulose in cupri-amine bases is due to the formation of a complex copper-cellulose anion. (2) The active component responsible for the dissolution of cellulose in copper-saturated cupriethylenediamine is most probably the dimeric compound  $[\text{Cu en}_2][\text{Cu}(\text{OH})_2]$ , or some similar solvated compound. (3) The active components responsible for the dissolution of cellulose in the copper-diamine solution containing a large excess of ethylenediamine may be  $(\text{Cu en}_3)(\text{OH})_2$  and  $\text{Cu}(\text{OH})_2$ . The similarity of the blue colour of the two active diamine solvents indicates, at least superficially, that some form of cupric hydroxide may be responsible for the cellulose-complex formation, and hence its dissolution. This is in accord with the nature of the compounds proposed. The blue-violet cupri-di-ethylenediamine compound is not a solvent for cellulose. (4) The ratio of total diamine to total copper in saturated solutions is probably less than 2:1, which indicates that both the cupri-mono-amine and cupri-di-amine are present. This ratio and the equilibrium between the mono- and di-compounds are dependent on concentration, and until more refined methods of analyses are made available the exact nature of these ratios and equilibrium constants cannot be accurately determined. (5) The cupriethylenediamine and cupraammonium systems may be considered similar in all respects except in the stability of the two complexes. (6) Copper appears to retain a coordination number of 4 in its complex formations, but it appears probable that an additional two groups may be added to the complex in the form of loosely bound constituents, similar to water of crystallisation, giving copper an apparent coordination number of 6. C.

**Nitrocellulose Fractions: Sedimentation and Molecular Weight.** H. Mosimann. *Helv. Chim. Acta*, 1943, 26, 369-398 (through *Chem. Abstr.*, 1943, 37, 6522<sup>a</sup>). A new sedimentation cell of synthetic resin (Tufnol) mounted in a metal cylinder is described. Instead of using a blanketing liquid layer to minimize solvent evaporation the author closed the cell with a screw and the fact that the quartz windows were only 18 mm. in diameter decreased the danger of their breaking. Although equilibrium was apparently attained in 4 days, all tests were continued for a total of 6 days. The nitrocellulose fractions described in a previous paper were studied. Correct values of molecular weight,  $M$ , are obtained only in dilute solutions where  $M$  is independent of concentration, centrifugal field and solvent. Nitrocellulose fractions having  $M$  over 80,000 deviated in behaviour at the lowest concentrations that could be tested. One

fraction, which revealed more than one maximum in the velocity centrifuge, gave decidedly anomalous results because part of the material actually sedimented to the bottom of the cell in the equilibrium run. Except perhaps at low values of  $M$ , viscometric molecular weights were not linearly related to  $M$ , but gave a curve convex to the  $M$  axis. C.

**Starch: Crystallisation from Solvent Mixtures.** E. Wiegel. *Kolloid Z.*, 1943, 102, 145-154 (through *Chem. Abstr.*, 1943, 37, 6926<sup>9</sup>). Optimum concentration of ethyl alcohol for crystallisation of starch was 30-35 per cent. Other solvents used included butyl alcohol, isobutyl alcohol and isopropyl alcohol. Photo-micrographs and X-ray diagrams are shown (in the original paper). On freezing concentrated solutions, a filamentous form which went over to an amorphous form was obtained. C.

**Ozone: Adsorption by Silica Gel, Alumina Gel and Cotton.** E. Briner and A. Lachmann. *Helv. Chim. Acta*, 1943, 26, 346-357 (through *Chem. Abstr.*, 1943, 37, 6532<sup>11</sup>). In experiments at 0, 100, 200 and 400° with mixtures of sulphur dioxide and oxygen in contact with partially dehydrated silica gel very little sulphur trioxide was formed. Whilst the addition of ozone to the gas mixture greatly increased sulphur trioxide formation, the oxygen fixed was only 10-20 per cent. of that contributed by the ozone; an optimum was found at 200° C. Thus the use of ozone together with silica gel has little value for sulphuric acid manufacture. The reaction probably proceeds through formation of sulphurous acid on the gel and subsequent oxidation, accelerated by ozone to sulphuric acid. Direct oxidation of sulphur dioxide by ozone is believed not to take place, for when a mixture of these gases is adsorbed on the gel at low temperatures, the blue-violet colour characteristic of ozone persists. Adsorption of ozone on silica gel increased greatly as the temperature decreased from 0° to -80°; at the same time the proportion of ozone decomposed decreased. Alumina gel gave nearly the same magnitude of ozone adsorption and decomposition. Absorbent cotton also adsorbs ozone about as well as the gels, but decomposes it less, which explains the persistence of ozone odour on cotton. C.

**Liquids: Wetting and Spreading.** L. J. Bircher. *J. Chem. Education*, 1943, 20, 428-430 (through *Chem. Abstr.*, 1943, 37, 6517<sup>7</sup>). One liquid will wet a second liquid only if the work of adhesion of the former for the latter exceeds the work of cohesion holding the molecules of the former in a drop. This theory is demonstrated in a laboratory experiment by determining surface tension of solutions containing different molecular ratios of caustic soda and lauric acid, and by determining interfacial tensions of each of these solutions against a drop of paraffin oil. A solution of a wetting agent is also studied. C.

**Surface Tension Dynamometer: Wall Effect.** F. de Block and J. Mattheeuws. *Wis-Natuurkund. Tijdschr.*, 1940, 10, 22-27 (through *Chem. Zentr.*, 1941, 1, 2938-2940 and *Chem. Abstr.*, 1943, 37, 6510<sup>9</sup>). Comparative measurements of surface tension by the rupture method, the height-of-rise method, and the drop-weight method are discussed together with the possible reasons for variations in results. In order to study the effect of the material in the rupture method, tests were made with cylinders of various materials including stainless steel, "staybrite" steel, Zn, Mg, Al, a hard Al-Cu alloy, Cu, and Ni-, Au- and Pt-plated Cu. In determinations of the surface tension of water, carbon tetrachloride, heptane and acetone the deviations found were sometimes 10-20 times as great as the observed error. The deviations were certainly due in part to the nature of the metal, probably also to the different physical and chemical behaviour of the liquids investigated, polar effects at the cylinder wall, the microscopic form of the edge or the type of mechanical treatment to which the material had been subjected. Investigations of these factors are in progress. C.

**Fibres: Genesis.** W. Ostwald. *Kolloid Z.*, 1943, 102, 181-199 (through *Chem. Abstr.*, 1943, 37, 6518<sup>9</sup>). Types of hollow fibres, open, closed hollow, open septate, and closed septate, with apical, basal or intermediate growth, are discussed from the point of view of aluminium hydroxide fibres and silicate fibres. Such fibres are essentially membranes with liquid contents. C.

**Porous Solids: Permeability to Gases and Liquids.** L. Grunberg and A. H. Nissan. *J. Inst. Petroleum*, 1943, 29, 193-225 (through *Chem. Abstr.*, 1943, 37, 6517<sup>6</sup>). The authors have not established any correlation between the permeability of porous media to gases and to liquids. Permeability to gases depends mainly on the "Reynolds number," defined as the mean linear speed of the gas. Permeability to liquids depends not only on the viscosity, but also on the density and the surface tension. Temperature is a factor for the same liquid but a correction for this can be calculated. C.

**Organic Compound Solutions: Viscosity and Molecular Structure.** H. Staudinger. *Z. Elektrochemie*, 1943, 49, 7-16 (through *Chem. Abstr.*, 1943, 37, 6524<sup>8</sup>). The viscosity of solutions of compounds with small molecules is described. The relation between the viscosity number and molecular weight is developed and verified by experimental data on organic compounds in various solvents. The viscosity of colloidal solutions is considered and the relation between the viscosity number of the molecular weight or chain length of substances with large molecules (colloidal) is developed in agreement with experimental data. C.

**Plastics in Organic Solvents: Viscosity/Concentration Relations.** H. Eilers. *Kolloid Z.*, 1943, 102, 154-169 (through *Chem. Abstr.*, 1943, 37, 6523<sup>8</sup>). Since in solutions of organic substances of high molecular weight the volume of the disperse phase is greater than would appear from the volume of the dry material, the author's previously proposed equation for emulsions must be corrected for the increased bulk by the factor  $V$ . This is found to be a function of concentration. When the rheological concentration,  $V^{1/3}C_v$  (where  $C_v$  is the volume of dry particles), is greater than 0.65, deviations occur because the particles no longer fulfil the requirements of being spherical, non-deformable and equal in size. Data from the literature for solutions of phenol-formaldehyde resins in acetone, polystyrene in tetralin, poly- $\omega$ -hydroxydecanoic acid in *sym*-tetrachlorethane, polyethylene oxide in dioxane, cellulose acetate in *m*-cresol, nitrocellulose in butyl acetate, and rubber in chlorobenzene are studied in the light of equations developed. C.

**Polymer Solutions: Viscosity.** G. V. Schulz and Gertrud Sing. *J. prakt. Chem.*, 1942, 161, 161-180 (through *Chem. Abstr.*, 1943, 37, 6540<sup>4</sup>). The method given earlier for calculating the viscosity number is confirmed by measurements on polyisobutylene, polymethacrylate esters, polystyrene and poly-11-hydroxyhendecanoic acids. It is found that the viscosity constant is independent of the nature and the molecular weight of the solute for the above compounds, the nature of the solvent and the molecular branching. The concept of a limiting concentration and the influence of the solute are discussed. C.

**Electron Microscope; Electron Diffraction in —.** M. von Ardenne, E. Schiebold and F. Günther. *Z. Physik*, 1942, 119, 352-365 (through *Chem. Abstr.*, 1943, 37, 6542<sup>9</sup>). Electron-diffraction patterns of small regions in the field of vision of an electron microscope can be obtained by adding a magnetic lens of short focal length which causes a reduction of the diameter of the electron beam to values from 1 to 150  $\mu$ . By means of a simple mechanical manipulation, the position of the electron probe can be shifted to any point in the object plane. The co-ordinates of the point where the probe strikes the diffraction diagram yield the position of the probe in the object plane. The application of the method to fibre chemistry is discussed. C.

**Optical Linear-dynamo-dilatometer.** E. Wöhlisch. *Kolloid Z.*, 1942, 100, 151-153 (through *Chem. Abstr.*, 1943, 37, 6499<sup>8</sup>). The apparatus, equipped with an optical reading device, enables a complete thermodynamic analysis to be made of linear elastic changes in a highly elastic specimen during, for example, expansion and decompression. With this apparatus the thermal changes in the elastic tension at constant length can be determined, as well as the thermal changes in the length at constant tension at any degree of expansion. C.

**Isotropic Plastic Solids: Stress-Strain Relations.** W. Prager. *J. Applied Physics*, 1944, 15, 65-71. Combined torsion and tension of thin-walled tubes constitutes one of the few testing arrangements in which a fairly general state of

uniform stress can be realized without too great experimental difficulties. A manner of representing graphically the results of such tests is used in a discussion, in geometrical terms, of some stress-strain relations of the mathematical theory of plasticity. It is shown that the theories of Saint-Venant, Lévy, and Mises lead to physically unacceptable conclusions unless the material is supposed to be rigid as long as the stresses have not reached the yield limit. The predictions of the theories of Prandtl, Reuss, Hencky, and Nadai are compared with the results of experiments on mild steel; the possible effects of viscosity and strain hardening are discussed. C.

**Polystyrene: Effect of Ultrasonic Waves.** G. Schmid and E. Beuttenmüller. *Z. Elektrochemie*, 1943, 49, 325-334 (through *Chem. Abstr.*, 1943, 37, 6522<sup>9</sup>). Experiments have been made on the effect of high-frequency sound (284 kilocycles) on the decomposition of polystyrene in mixtures of solvents of different densities at 50°. The density of the solvent has no effect on the decomposition. This leads to the conclusion that the decomposition depends on the difference in the deformability between the polystyrene molecule and the solvent. C.

#### PATENTS

**Cellulose Acetal Derivatives: Preparation.** Carbide and Carbon Chemicals Corporation. U.S.P.2,329,741. Partially alkylated cellulose acetals are prepared by the interaction of a water-soluble partially alkylated cellulose with an aldehyde of the formula  $R \cdot CO \cdot CHO$ , where R is H or an alkyl radical. The products are insoluble in water, acetone and the lower alcohols. C.

**White Mineral Wax: Protection Against Light.** Socony-Vacuum Oil Co., Inc. U.S.P.2,331,469. A white, refined paraffin wax is protected against darkening on prolonged exposure to light by the admixture of a small amount of triamyl-, tributyl-, diamyl-, dibutyl-, or mono-butyl-amine. C.

### 10—ECONOMICS

**Rayon: Production in the United States, 1933-43.** *Rayon Textile Monthly*, 1944, 25, 5. The growth in the production of rayon in the United States is shown graphically. For 1943, the totals were 524 million lb. of continuous filament and 167 million lb. of rayon staple. The classification by process is given as viscose nearly 68 per cent., acetate nearly 27 per cent., the new group comprising Aralac, Nylon, Vinyon, etc., over 4 per cent., and cuprammonium over 1 per cent. C.

**Rayon: World Production, 1942.** *Rayon Textile Monthly*, 1944, 25, 8. A table records reliable data for 1939 of continuous filament and rayon staple production in all the known producing countries and the best available estimates for 1942. Attention is called to the extraordinary rise of 56 per cent. since 1939. Rayon staple production has increased by 87 per cent. and in the United States has trebled itself. C.

**Textile Wholesale Prices, February, 1944.** *Bd. Trade J.*, 1944, 150, 101. The wholesale price index numbers for February are Cotton 139.5, Wool 182.8, Other textiles 133.7 (1930=100). C.

**Textile Operatives' Earnings, July, 1943.** *Textile Weekly*, 1944, 33, 404. Average earnings in the first pay-week of July, 1943, and percentage increases over the last week in October, 1938, are tabulated for men, youths and boys, women, girls, and "all workers," in the main branches of the textile industry. C.

**Weaving Wage Lists: Improvement.** H. Brookes. *Textile Manufacturer*, 1944, 70, 56-59. Criticisms of the present "Uniform List" are enumerated and attempts to simplify the system are reviewed. The writer advocates a system that is based on the loom instead of on the cloth produced. Each loom would be credited with a "permitted maximum speed" and there would be every incentive to increase the loom efficiency. A "standard percentage efficiency" would be ascertained for the loom by tests involving reasonable expenditure of skill and energy by the operative and there would be a "standard wage" for maintaining this efficiency. Hypothetical cases are worked out. C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Corrosive Acids: Handling.** U.S. National Safety Council. *Textile World*, 1943, 93, No. 12, 102. Methods for removing acids from carboys, and precautions to be observed in handling acids are enumerated in concise paragraphs. C.

**United States Textile Research Institute: Applied Research Programme.** G. E. Hopkins. *Textile Research*, 1943, 13, No. 14, 12-13. The applied research work will attempt to develop the application of fundamental principles to a point where competent mill technical staffs can "pick up the ball." The Director hopes to visit the technical staffs of all members to learn their problems and from these to select common denominators, of value to sections of the industry, and requiring more comprehensive study than may be afforded by individual laboratories. The contacts will include all laboratories working in the textile field. In addition the work of the engineering laboratories, the equipment manufacturers, the chemical industry and the electrical industry will be closely followed. The establishment of a large independent laboratory is not contemplated. The research committee, supplemented by consultants to be called upon according to particular problems, will subcontract the actual work to existing facilities, textile schools, engineering schools and sometimes members' laboratories. The functions of the applied research section are defined as recognition and definition of common problems, determination of the principles involved in their solution, selection and provision of proper facilities for their study, and the interpretation and distribution of the results. C.

**United States Textile Research Institute: Organization and Plans.** F. S. Blanchard. *Textile Research*, 1943, 13, No. 14, 4-7. A report is given of the organization, progress and future plans of the U.S. Textile Research Institute. A number of supplements and information reports on mildew-proofing of military fabrics, water-repellency, fire-proofing, bibliography of nylon, handling of high density cotton, etc., have been issued, and a committee on economic research has been set up. It has been decided (1) that the Institute should cover all branches of the textile industry, and all fibres; (2) that the laboratories should be near but not in New York; (3) that the Institute should have a five-point programme covering (a) fundamental research, (b) applied research and mill contacts, (c) a graduate school in affiliation with a leading university, (d) economic research, (e) information service, publications, abstracts, library, etc.; and (4) that a research fund of \$300,000 a year for five years, or \$1,500,000 plus a capital fund of \$500,000 should be solicited from all major branches of the industry. The Textile Research Institute is working in close cooperation with the Textile Foundation. C.

**Cotton Bacterium: Characteristics.** B. H. Caminita, R. Schneiter, R. W. Kolb and P. A. Neal. *Publ. Health Rep. Wash.*, 1943, 58, 1165-1183 (through *Bull. Hygiene*, 1944, 19, 41). An illness caused by inhaling cotton dust has been attributed to the endotoxin of the "cotton bacterium." The present paper describes the characters of 107 strains of this organism. It is a capsulated motile Gram-negative bacillus forming mucoid, often yellowish colonies. Failure to form indole, negative methyl red reaction, positive Voges-Proskauer and growth in sodium citrate identify it as an *Aerobacter* and gelatin liquefaction and incomplete fermentation of glycerol further identify it as *A. cloacae*. By the study of many other characters the 107 strains were separated into three types, with a fourth miscellaneous group: that designated Type I predominated, and it is this type which has been shown in various ways to possess the endotoxin to which mill fever is attributed. Serological studies showed the group to be antigenically heterogeneous. Information is also given about pathogenicity for animals, viability under natural conditions, and the effects of inoculating cotton plants. C.

**Formaldehyde Resin Dermatitis: Prevention.** K. E. Markuson, T. F. Mancuso and J. S. Soet. *Industrial Medicine*, 1943, 12, 383-386 (through *Bull. Hygiene*, 1944, 19, 39-40). Phenol- and urea-formaldehyde resins are primary skin irritants. On exposed parts a fine rash appears, associated with itching and erythema; scratching accentuates the condition, but most cases improve with

care. After recovery, individuals become hardened or immune to further contact, but this immunity may be lost and then severe dermatitis may follow. The onset usually occurs from three to six weeks after the initial exposure to the resin; the majority of cases are mild, and do not interfere with work. Under warm conditions, fumes rise from the resin and may cause conjunctivitis and redness of the face. Prevention is first an engineering problem to minimize the exposure in every way by introducing machinery to replace manipulation, by keeping processes enclosed, by controlling the escape of dust and fumes into work-places, and by keeping benches, floors and other surfaces clean. Protective clothing, kept scrupulously clean, must be worn; exposed parts may be protected with ointments and creams; frequent washing must be insisted upon. Workers must be taught how to work so as to avoid exposure. C.

**Light Metal Splinters: Injurious Effects.** *Industr. Bull.*, 1943, 22, 251-253 (through *Bull. Hygiene*, 1944, 19, 39). Splinters of light metal alloys of the Dural group, containing 93-95 per cent. aluminium, 3.5-4.5 per cent. copper, 0.6-0.8 per cent. magnesium, and smaller amounts of silica, manganese and iron, cause inflammatory reactions when they pierce the skin. The magnesium is responsible for the disturbances. Two or three days after a splinter has gained access to the skin a reaction develops which involves the surface and the deeper tissues. A local abscess may follow, with lymphangitis and lymphadenitis. A worker may also develop eczema and itching after three months' exposure to the dust. The splinters of light metal alloys have small barbed hooks, which attach themselves to the skin. An agar culture medium which contained light metal grew an astonishing number of such organisms as staphylococci, but when treated with heavy metals remained sterile. Magnesium in tissues results in decomposition of water, with the formation of vacuoles containing bubbles of hydrogen. The condition usually heals without any disability in under 14 days. Visible splinters should be removed; hydrogen peroxide bubbles help to float them to the surface. The dissemination of light metal dusts in workshops should be controlled; after work the skin should be carefully cleaned, and so should all tools used. Such care has appreciably reduced the number of cases. C.

**Time-study Board.** C. Hintz. *Machinist*, 1944, 87, 97. A board for time-study observations which holds the stop watch in line with the work and holds the analysis sheets so that they will neither slide nor curl is shown. It is cut from a  $\frac{1}{4}$ -in. sheet of laminated, duck-base phenolic plastic and guides for the analysis sheets, made of strips of stainless steel, are provided on the upper, lower and right-hand edges. The guides project  $\frac{1}{8}$  in. above the surface of the board, allowing a substantial stack of analysis sheets to be held at one time. A spring clip at the upper right-hand corner helps to hold the sheets in position. A projection near the right-hand top corner carries a watch holder which supports the stop watch at an angle of  $30^\circ$  to the board. A board designed for  $8\frac{1}{2} \times 11$  in. sheets can conveniently be held on the left forearm and grasped around the projection which holds the watch. This assures a steady rest while recording times and a convenient control of the stop watch.

**Halowax Acne: Occurrence and Prevention.** C. K. Good and N. Pensky. *Arch. Dermat. & Syph.*, 1943, 48, 251-257 (through *Bull. Hygiene*, 1944, 19, 125-126). A report is given of 52 cases of "Halowax acne" ("cable rash") following contact with Halowax, a mixture of chlorinated naphthalene and diphenyl, used for insulating electric cables. In making connections, the Halowax is removed from the copper strands, thus generating a fine grey dust; heat may be required to effect connections and fumes may then arise. The effects and symptoms are recorded. Most cases improved under treatment in cool weather, but in a few the eruption persisted for 18 months after freedom from exposure. Skin cleansing with soaps and ointments is indicated. X-Ray and ultra-violet therapy were of value in relieving symptoms and hastening recovery. Risks were lessened by the provision of blower and exhaust fans; frequent washing was called for; special soaps and skin creams were provided, as well as overalls, face masks, sleeves and trousers. Such clothes, however, by increasing sweating seemed to make matters worse. Experiments are in progress with new pentasols applied to the skin. No evidence has come to light that Halowax causes any systematic disturbance. C.

**Operatives: Psychology and Management.** May Smith. *Textile Weekly*, 1944, 33, 435-436. A condensed report of an address to mill managers on the symptoms of fatigue, vocational guidance and selection, motion and time study of operations, and the importance of the sympathetic and balanced character of the manager. C.

**Co-operative Research for Indian Industry: Organisation.** Sir S. S. Bhatnagar. *Indian Textile J.*, 1943, 54, 105-106. Developments in the production of chemicals in India are outlined, and the organization of co-operative research in England and the work of the Research Associations are discussed. The formation of similar organisations in India is recommended, and it is suggested that a centre of industrial research in connection with the chemical industry could be started in Calcutta University. The need for large Government grants and for donations from industry for industrial research is pointed out. C.

**Research Workers: Education and Place in Industry.** A. P. M. Fleming. *Engineer*, 1944, 177, 234-235. A report of an address to the Manchester Chamber of Commerce. Research workers are divided into two broad types: (1) those engaged in the pursuit of knowledge for its own sake—the workers in pure or fundamental science, and (2) those engaged in applying the new discoveries to useful purposes—the applied or industrial research workers. The functions and education of both types are discussed, and it is pointed out that, whereas it is not essential for the researcher in pure science to have industrial experience, such experience is necessary for the industrial research worker. In the chemical industry the best plan may be to continue for a few years a post-graduate course in an advanced field of chemistry, and then to enter a laboratory in the chemical industry. It may be preferable for an engineer to leave the university on graduation and spend the next year or two as an apprentice in an engineering firm possessing a research organisation. After acquiring a knowledge of works organisation and problems he would proceed to the research laboratory. Such a plan is practicable only in the large organisations with established research facilities and in the national interests large industrial concerns should be willing to train research workers for their entire industry. An alternative would be to use the facilities of the Research Associations on the lines of the plan developed by the British Cotton Industry Research Association. The industrial research worker should be trained to sell his abilities and to give service in such a tactful way that his help is welcomed and not resented. The large concern with its own research organisation is able to bring quickly to bear on its problems all new relevant scientific knowledge, but the small concern is at a disadvantage and manufacturing firms in this country are mostly small. The solution would be for each small company to have at least one technically-trained officer able to translate and make effective all the appropriate new knowledge provided, e.g. by the Research Association of the industry concerned. Comparisons with the United States and Soviet Russia indicate that in this country the quality of research is satisfactory, but the number of research workers is far too small. In the future, to an increasing extent, industrial problems will be undertaken by mass attack, and numbers will play an important part. Our disadvantage in this respect could be minimised by encouraging a scientific attitude of mind throughout industry and ensuring that technicians and artisans adopt that attitude of mind and mobility and skill which will enable them to turn new developments to account quickly. C.

**Russian Engineers: Education.** J. G. Tolpin. *Chem. & Eng. News*, 1943, 21, 2090-2099. The rapid development of industry in the Soviet Union since 1920 and methods used to stimulate production are discussed, and an account is given of the facilities for general and vocational education and of the aims, organisation and work of the engineering colleges. C.

**Swedish Textile Research Institute: Establishment.** *Textile Mercury & Argus*, 1944, 110, 289. It is reported that a new institute for scientific and technical research on textiles will soon be erected close to the Chalmers High School of Technology in Gothenburg, with which it will be associated. The machinery and instrument equipment are being supervised by Professors Hultin, Hoessjer and Svedberg and Chief Engineer Engblom. C.

## PATENT

**Loom for Occupational Therapy.** C. W. Harris. B.P.559,568 of 9/7/1942: 24/2/1944. A loom for occupational therapy is provided with a number of alternative means of performing one or more of the operations in weaving by different selected muscular movements or combinations of selected muscular movements of the patient. The loom is provided with alternative operating means such as drums, wheels, levers, pedals, roller paths or the like with readily attachable and detachable operative connections and (if and as necessary) jockey pulleys and guides or the like, which enable it to be set up at different times to suit a variety of patients. Details are given of a loom with various arrangements for operating the healds by wrist, arm, leg or foot movements. C.



# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### LIST OF ABTRACTORS

The Abstracts in this section of the "Journal" are supplied by the following Organisations, and the source indicated by the initials hereunder shown.

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In this Section the abstractors give digests of reports published in technical and scientific periodicals of the whole world. The opinions and claims expressed in the abstracts are those of the original authors and it must be understood that the staff of the Textile Institute do not necessarily endorse them.

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL

**Merino Skinfolts: Origin.** N. de la Harpe. *South African Merino Breeders' J.*, 1944, 6, No. 1, 19-20. Selection for greater quantity of wool necessitates selection for more intense activity of the physiological functions of the pelt. Expansion of surface area in the skin of the merino has been powerfully encouraged by selection for fleece density, with the consequent formation of skinfolts. This theory implies the closest relationship between skinfolts and the potentiality for high wool production. W.

**Stud Sheep.** G. E. McCabe. *South African Merino Breeders' J.*, 1944, 6, No. 1, 15, 17. Pepler's view that skinfolts in stud sheep should be discouraged (these *Abs.*, 1944, A45) is unsound. The ideal sheep has been gradually evolved, and if the stud animal were not developed the sheep would revert to its original hairy covering. W.

**Sheep: Development a Necessary Evil.** P. H. Brodie. *South African Merino Breeders' J.*, 1944, 6, No. 1, 11, 13. A small amount of skinfold (the animal in full wool appearing entirely plain-bodied) is necessary in stud sheep of the highest merit, so that flock sheep can have sufficient wool covering to make them an economic proposition. W.

**Sheep: Maintaining the Ideal Type.** T. B. Jordaan. *South African Merino Breeders' J.*, 1944, 6, No. 1, 8-9. Continuous use of only extremely plain-bodied sires would cause loss of staple formation and substance, which are the essential fleece characteristics of a stud merino. W.

**(C)—VEGETABLE**

**Cotton Crop: Influence of Climate.** C. B. Doyle. *U.S. Dept. Agric. Yearbook Separate* No. 1805, 1941, pages 348-363. A broad review of the influence of climate on the cotton crop, under the headings (1) Distribution of cotton-growing areas, (2) Weather conditions favourable for cotton, (3) Relation of climatic factors to yield, (4) Effects of exposure and harvesting methods, (5) Commercial types of cotton, (6) Principal regions of production (acreage and yields), (7) Cotton soils of the United States, and (8) Climate of the Cotton Belt. [No bibliography is provided but the review is valuable for its information about the American crop.] C.

**Bast and Leaf Fibres: Production in the Americas.** L. H. Dewey. *U.S. Dept. Agric. Misc. Publ.*, No. 518, 1943, 95 pages. A useful, illustrated account of the principal vegetable fibres, other than cotton and flax, produced in the Western Hemisphere. The main headings are (1) Classification and nomenclature; (2) Long or multiple-celled fibres, (A) hard or leaf fibres (henequen, sisal, letona, mezcal, zapupe, cantala, lechuguilla, Jaumave lechuguilla, furcraea, piteira, cabuya, fique, chuchao, cocuiza, pitre, common yucca, soapweed yucca, palmilla, banana yucca, mohave yucca, palma pita, palma barreta, Zaman-doque, Chaparral yucca, pita floja, phormium, abacá) (B) palm and palm-like fibres (Bahia piassava, Pará piassava, cabbage palmetto, scrub palmetto, pita de corajo, yaray, toquilla, (C) soft or bast fibres (hemp, cadillo, jute, ramie); (3) Short or one-celled fibres (kapok, pochote, Northern pochote, palo borracho, samohu); (4) Miscellaneous (broomroot, treebeard). The botanical names and descriptions are given and the production and marketing of the fibres are described. C.

**West Indian Cotton: History.** S. G. Stephens. *Tropical Agriculture*, 1944, 21, 23-29. The history of cotton growing in the West Indies during the 18th and 19th centuries is reviewed and extracts are given from historical records. Although cotton was found growing in the West Indies in some abundance by the early Spanish settlers in the 16th century, it does not appear to have attracted much attention for the next hundred years. The increased demand for cotton in the 18th century and the appearance of the sugar ant in the West Indies caused a rapid change from cane to cotton growing. The naked and tufted seeded varieties of cotton grown in the West Indies (shrub cottons) could be readily de-linted by roller gins whilst the green-seeded variety grown in the Southern States of America required hand de-linting and did not at first offer any serious challenge to the pre-eminence of West Indian cotton in European markets. After the invention of the Whitney saw-gin in 1793 American cotton production soared and West Indian production declined. In 1801 25,000 bales of cotton were shipped from the West Indies and by 1836 this figure had fallen to 20,000 bales. From then onwards cotton production rapidly diminished except for a short renewal during the American Civil War (1863-5) when cotton exports to Europe from the States were temporarily suspended. Only in the Grenadines did cotton growing persist into the 20th century. There appears to be no reason to suppose that perennial cottons found in the West Indies to-day differ from those cultivated in the 18th and 19th centuries. There is a strong possibility that *G. hirsutum* var. *marie galante* formed the major constituent of the crop. C.

**Bollworm: Control.** K. P. Ewing and E. E. Ivy. *J. Econ. Entomol.*, 1943, 36, 602-606 (through *Chem. Abstr.*, 1944, 38, 827<sup>4</sup>). Timely applications of heavy doses of calcium arsenate control *Heliothis armigera*. Light or improperly timed applications may result in heavier infestations of this insect on the treated than on undusted cotton plants. This increase is frequently associated with increase in aphid populations owing partly to the attraction of bollworm moths to the aphid honeydew. A more important factor is the reduced feeding of predacious insects on bollworm eggs when aphids are abundant. C.

**Boll Weevil and Bollworm: Control.** K. P. Ewing and C. R. Parcencia, Jr. *J. Econ. Entomol.*, 1943, 36, 607-610 (through *Chem. Abstr.*, 1944, 38, 827<sup>2</sup>). The comparative effectiveness of reduced dosages of calcium arsenate and the possibility of substituting cryolite for calcium arsenate for boll-weevil (*Anthonomus grandis*) control were investigated. Calcium arsenate, basic copper arsenate, lead hydroarsenate and cryolite were compared for effectiveness.

against the bollworm (*Heliothis armigera*). The boll-weevil population in the experimental plots was light, and few marked differences were evident between treatments. Calcium arsenate dosages of 8 lb. per acre failed to control the bollworm; 16 lb. per acre resulted in a significantly greater yield of cotton. Basic copper arsenate-sulphur mixture (1:2) at 16 lb. per acre equalled calcium arsenate applications of 12.5 lb. per acre in cotton yield. At dosages of 8 lb. per acre, basic copper arsenate, lead hydroarsenate or cryolite resulted in higher yields than the same dosage of calcium arsenate. C.

**American Cotton Crop: Post-war Position.** I. W. Duggan. *Textile Weekly*, 1944, 33, 626-630. A report of an address on the post-war prospects for American cotton. The following relevant facts are adduced: Exports of American cotton fell to about 1 million bales in 1940-41, but home consumption reached 11 million bales in 1941-42 and 1942-43. The world's supply of American cotton for 1943-44 is nearly 23 million bales. The "carry-over" at 1st August, 1943, was 11½ million bales, including a disproportionately large bulk of shorter staples and lower grades, but American mills demonstrated in 1942-43 their ability to use more of these growths. The American acreage for the 1943 season was 22 millions, and the crop estimate is 11.2 million bales; the record crop was 18 millions in 1937 and 1926. The acreage under cotton outside the United States in 1942-43 was 46 million and the crop 14 million bales; the largest relative reduction was in Egypt. Present production of continuous filament and spun rayon is equivalent to nearly 8 million bales of cotton. A plea is made for Government assistance to farmers so that the income from cotton may be increased. Nearly one-third of all the farm people in the United States live on cotton farms. C.

#### (D)—ARTIFICIAL

**Cotton Linters: Production and Application.** Emily L. Day. *U.S. Dept. Agric., Agric. Econ. Bibl.*, No. 88, 1940, 39 pages. Brief abstracts are given of 205 papers published between 1900 and 1940, classified under (1) General, (2) Methods of recovery, (3) Quality, (4) Commerce, (5) Uses, and (6) Legislation, regulation and adjudication. An index is provided. C.

**Unbleached Pulp: Action of Nitrogen Dioxide on —.** G. L. Clarke. *Paper Trade J.*, 1944, 118, TAPPI, 62-66. In an attempt to replace chlorine entirely or partly by other bleaching agents, experiments were made on the effect of nitrogen dioxide on unbleached pulp. When liquid nitrogen dioxide was introduced into an aqueous pulp suspension and the mixture was heated for 1 to 1.5 hours at about 90° C., the lignin constituent was so changed that it could be removed by hot caustic extraction. Since nitrogen dioxide in the presence of water is converted into a mixture of nitrous and nitric acids, the delignification cannot be carried to completion without considerable damage to the cellulosic constituent, which limits the use of nitrogen dioxide to the first stage of bleaching, comparable with the chlorination stage. After extraction with a small amount of hot caustic soda, the partly bleached pulp may be bleached to the desired colour with hypochlorite. If the brightness is limited to 70 to 75, a considerable amount of chlorine bleaching agents may be replaced by nitrogen dioxide. Pulp bleached in this manner had physical properties which were not very different from those of pulp bleached by the chlorine-hypochlorite method with cold caustic extraction between the stages. The α-cellulose content of the two pulps was about the same, but the viscosity was lower for the nitrogen dioxide-bleached pulp, probably as a result of the action of the nitrous and nitric acids formed. The indications were that the combined action of these two acids is responsible for the bleaching effect. It is suggested that the reaction comprises two phases, the nitration of the lignin residue and the oxidation of the nitrolignin, the latter phase resulting in the solubilization of the modified lignin. The nitrogen content of the treated pulp and the results of experiments with mixtures of sodium nitrite and nitric acid and with nitrogen dioxide and nitric acid seem to support this hypothesis. C.

**Sunflower Stalk Pulp: Production.** K. H. Rauch. *Angew. Chem.*, 1940, 53, 568-573 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 37). A pulp which, after normal refining, was suitable for viscose was obtained by digesting sunflower stalks (fat + resin + wax 6.4, lignin 30, cellulose 37.6, ash 4.3 per cent.) with a liquor containing calcium oxide 0.98, free sulphur dioxide 1.86, and

combined sulphur dioxide 1.08 per cent. for 36 hours at 115-125° followed by bleaching for 10 min. at 30° with bleaching powder. The yield was 32.2 per cent. (α-cellulose 84.6 per cent.) and molecular size (viscosity method) 92,000. Analytical data are tabulated for pulps either isolated in the laboratory by hydrolysis (sulphuric acid alone or followed by caustic soda) and oxidation (nitric acid, chlorine, chlorine dioxide, or bromine) methods, or obtained on the semi-commercial scale by the caustic soda and kraft processes. A stable cellulose flour suitable for cattle fodder is obtainable as a by-product of the mechanical pre-treatment of the stalks. C.

**Man-made and Natural Fibres: Names and Sources.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 356-365. Lists are given of all the fibres that are available in commercial quantities, grouped into (1) man-made fibres and filaments, (2) animal fibres, (3) mineral fibres, (4) seed hairs, and (5) bast and leaf fibres. The names are in alphabetical order and parallel columns give synonyms, verbal descriptions (occasionally) and sources. Scientific names are in italics and the most common names in capital letters. C.

#### PATENTS

**Protein Filaments: Hardening.** A. McLean, S. R. Swift and Imperial Chemical Industries Ltd. B.P.559,818 of 2/9/1942:7/3/1944. A process for the production of protein filaments comprises extruding a solution of the protein, e.g. vegetable globulin or casein, into a coagulating medium, washing the filaments in an anti-swelling medium, maintaining the filaments in a solution containing an anti-swelling agent, e.g. sodium chloride, together with urea, thiourea, biuret, or like bifunctional amide, and thereafter treating the filaments under acid conditions and while they are still impregnated with the solution with a hardening aldehyde capable of reacting with the bifunctional amide in the presence of acid to produce an insoluble condensation product. For the production of staple fibre, the washed coagulated filaments may be cut and the staple fibre steeped in the solution containing the amide. C.

**Soybean Protein: Production.** Ford Motor Co. Ltd. B.P.559,848 of 11/5/1942:8/3/1944 (Conv. 10/5/1941). Protein suitable for use in the production of artificial fibres, paints, sizes, etc., is obtained by extracting protein from soybeans by means of alkali solutions, clarifying the protein solution, treating it with acid, decanting the liquor from the protein precipitate, dehydrating the precipitate by slowly freezing at a rate which encourages the formation of large ice crystals, thawing the frozen precipitate, and then decanting the water from the protein. C.

**Fibrous Pulp Liquid Treatment Apparatus.** Thames Board Mills Ltd., M. H. Morley and H. N. Baker. B.P.559,909 of 5/3/1942:10/3/1944 and 559,913 of 12/6/1942:10/3/1944. (1) A device for the treatment of fibrous pulp material with liquor consists of a tubular chamber of greater length than diameter having outlet perforations for excess liquor adjacent the discharge end only of the chamber, means to feed fibrous material and a digesting liquor to the inlet end of the chamber, a rotating screw conveyor in the chamber adapted to apply mechanical pressure to the fibrous pulp material while it is in the chamber, and steam inlets spaced along the walls of the chamber. (2) In apparatus of the type described in (1), a gear wheel mounted on an axis at right angles to the axis of the screw conveyor in the tubular chamber meshes with the flights of the conveyor to apply pressure to the material and is disposed to lie partly within a feed hopper for the tubular chamber and partly in a housing on one side of the tubular chamber. C.

**Rayon Staple Cutting Apparatus.** American Viscose Corporation. B.P.559,995 of 19/8/1942:15/3/1944 (Conv. 10/4/1942). In apparatus for cutting rayon staple, means are provided for continuously varying the rate of delivery of the continuous filament to the cutting device by varying the distance from the feeding device to the cutting device during operation, e.g. by moving the cutting device continuously toward and away from the feeding device. C.

**Staple Fibre Cutting Apparatus.** American Viscose Corporation. B.P.560,018 of 19/8/1942:15/3/1944 (Conv. 10/4/1942). In apparatus for cutting continuous filaments into staple fibres wherein the distance between cuts can be varied by varying the rate at which the filaments are delivered to the cutting

device, the feeding device comprises a variable-speed delivery roller or a rotatable member of non-circular cross-section which is driven either at constant or varying angular velocity. C.

**Wetting Agents: Application in Viscose.** Rayonier Inc. U.S.P.2,331,935/6. The conversion of refined pulp, containing not more than 0.15 per cent. of matter extractable by ether, into viscose is assisted by (1) adding to the mass before xanthation is complete an anionic surface-active agent that is soluble in the alkalis employed or (2) adding to the pulp a cation-active quaternary ammonium salt compatible with the alkali. The amount of wetting agent used is 0.01-0.15 or 0.20 per cent. of the weight of bone-dry pulp. C.

**Glass Fibres: Spinning.** G. von Pazsiczky (Hamburg; vested in the U.S. Alien Property Custodian). U.S.P.2,331,944/5/6. (1) Roughened glass fibres are obtained by blowing hydrofluoric or phosphoric acid vapours against the molten glass as it is being drawn into filaments. (2) Curly fibres are obtained by spinning a mixture of two glasses that differ in coefficient of expansion. Streams of the molten glasses flow together to orifices. (3) The claim is for a melting receptacle in which the molten glass flows in a thin film over a dam to the spinning compartment. C.

**Rayon Spinning Bucket.** American Viscose Corporation. U.S.P.2,332,314. A centrifugal spinning bucket is fitted with means for draining solutions or suspensions from its immediate surroundings and means for spraying it intermittently during operation. The effluent is automatically switched from one channel to another when spraying occurs. C.

**Cotton Drying Machine.** M. I. Teague (Rochester, Texas). U.S.P.2,332,413. The claim is for a machine in which a screen is arranged over the inner end of the air intake tunnel and a rotary brush works inside the screen to remove foreign matter. C.

**Vinylidene Chloride Polymer Yarn: Preparation.** Dow Chemical Co. U.S.P.2,332,485. A group of filaments of normally crystalline vinylidene chloride polymer is subjected in the supercooled condition to stretching and false twisting. A diagram of the apparatus is given. C.

**Gin Saw Cleaner.** James Delashaw and F. D. Gibson. U.S.P.2,332,783. The device consists of a set of discs on a shaft so spaced that the separate plates of the gin saw will fit between them when the saw is mounted for cleaning. The discs carry cleaning blades mounted at reverse angles to the rims of the discs so that the inner ends of blades on adjacent discs cross and override the saw teeth as the cleaner is rotated. C.

**Flexible Corrugated Spool.** Industrial Rayon Corporation. U.S.P.2,332,826. A radially compressible, flexible spool is made by forming into a cylinder a sheet that, in the illustration given, resembles deeply corrugated packing paper. C.

**Endless Belt Yarn Collecting and Winding Apparatus.** E. I. Du Pont de Nemours & Co. U.S.P.2,333,278/9. (1) Yarn (from a liquid treatment bath) is collected on a slowly moving endless belt from which it is removed (for winding into a bobbin) by means of a pair of tapered rollers so that the point at which the yarn is taken off the belt occurs at a pre-determined point from the forward part of the belt. (2) The arrangement is used for handling a crinkled yarn and the take-off mechanism is adjusted to apply tension so as to remove any desired amount of crinkle. C.

**Glycinin-Viscose Mixture Filaments: Spinning.** Tubize Chatillon Corporation. U.S.P.2,333,527. A homogeneous mixture of viscose and an alkaline solution of glycinin made with the help of a hydroxyalkyl sulphonylate is spun into an acid bath. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Electro-pneumatic Opening Machinery: Advantages.** C. Consterdine (Messrs. Platt Bros. & Co. Ltd.). *Textile Weekly*, 1944, 33, 512-8, 552-6, 594-600. A report of a lecture on the single-process system of cotton opening. Present difficulties in the production of good laps are ascribed to (1) high-density baling,

(2) the wide range of cotton grades due to the extension of cotton growing to new areas, (3) the demand for the reduction of dust in mills, and (4) the demand for better laps for the better functioning of the carding engine. Modern developments in machinery to meet these demands, especially the adoption of electric controls and pneumatic mixing and conveying systems, are reviewed in some detail and the following machines (by Platt Bros. & Co.) are mentioned. Hopper bale opener with electrically-controlled feeding lattice, Hopper feeder with creeper lattice and dust fan, Super-grid-area porcupine opener with feed lattice and Shirley cage and fan, Crighton opener cylinder fitted with by-pass valve, Hopper feeder with condenser and fan fitted with delivery regulator reserve box and wiper roller, Double opener consisting of one 24-inch cylinder and one pair of cages, one beater part with feed lattice, feed roller, cages and fan for down draught, and by-pass valve to miss the beater part if required, and Electro-pneumatic automatic distributor with one inlet and two outlet valves to distribute cotton to two scutchers. C.

**Cotton Card: Evening Action.** R. W. Vose and C. H. Plummer. *Textile Research*, 1944, 14, No. 1, 20-24. An experimental procedure was devised in which identifiable lap irregularities of known amounts were introduced and the resulting irregularity was traced in the card sliver. In order to produce the desired irregularities it was found more practical to alter the linear rate of feed of a uniform lap than to form a lap with definite irregularities in weight from point to point. A differential mechanism was used to control the irregularity in the feed of the lap to the card. Variations in the feed were created with wave lengths of 1, 2, 4, 8 and 16 in., each with amplitudes of 5 per cent., 10 per cent., 20 per cent. and 40 per cent. Records obtained on a sliver tester show the sinusoidal variation in sliver weight plus much smaller superimposed irregularities evidently originating in the card. To obtain an index of the card action in reducing the sinusoidal irregularity of the lap as fed, the irregularity of the sliver was compared with that introduced in the feed. The percentage standard deviation of the sliver was divided into the percentage standard deviation of the lap feed to obtain a decimal fraction indicating that part of the feed irregularity which passed through the card and appeared in the sliver. A chart is given showing the variation of this fraction with the wave length of the lap irregularity. Irregularities of wave length shorter than  $\frac{1}{2}$  in. in the lap were largely absorbed by the card and did not appear in the sliver. Irregularities of wave length longer than 8 in. were reproduced essentially completely, without any modifications by the card. In the range between these two wave-lengths the card exerted a partial evening action. C.

**Speed-frame Products: Effect of Doubling on Yarn Strength.** *Cotton (U.S.)*, 1944, 107, No. 12, 122-123. Further evidence is given on the question whether it is possible to reach the Draper standards for yarn strength with few doublings. The writer regards these standards as "rather ancient" and prefers the strength graphs issued by F. P. Sheldon & Son (1926), which give slightly higher values than the latest Draper figures for counts up to 10s and rather lower values for finer counts. Particulars of the speed-frame processes used are recorded and the average strength results obtained in 1942 and 1943 are tabulated. In 1942 the results were above the highest Draper figures in all of the 16 counts spun (4s to 20s) except in 17½s and 20s. In 1943 the results were not up to standard except in counts below 10s. The writer ascribes this rather to the poor quality of the crop than the processing. C.

**Faults in Woollens: Defects in Raw Wool and Yarn.** *Wool Rec.*, 1944, 65, 464, 466. If mechanical removal of burrs is not possible in carding, the piece good are either carbonised or burl dyed. The formation of neps in carding may be prevented by reversing the direction of revolution for one of the workers working over the intermediate swift. This reversal is also applied successfully for the prevention of slubs in the carded sliver by applying it to the last worker on the woollen carder. W.

#### (B)—SPINNING AND DOUBLING

**Hank Clock Production Factor Table.** C. McElroy and M. Gross. *Textile World*, 1943, 93, No. 4, 131. The table gives the factor by which to multiply the weight of cotton yarn required in order to obtain the corresponding number of hanks for a 240-spindle frame. Thus, assume that 1000 lb. of 36s has to be

spun; the factor for 36s is 0.15 and the hank clock reading for the 240-spindle frame should be  $0.15 \times 1000$ , or 150 hanks. C.

**Modern Cotton Spinning Mill: Installation.** J. Buckley (Messrs. Platt Bros. & Co. Ltd.). *Textile Manufacturer*, 1943, 69, 65-68, 115-118, 161-164, 207-210, 253-255, 299-301, 341-344, 389-392, 398, 431-435, 479-481, 529-531; 1944, 70, 19-22, 65-66, 87, 113-115, 159-161. This series of articles is an expanded version of a lecture (already noted) covering the equipment now in sight that would make the cotton mill of the future. The series is illustrated by 156 pictures of machines, mills and lay-outs, and the main chapter headings are: (I) Modern cotton spinning machines and methods; (II) Cotton opening and lap forming; (III) Do., dust extraction and waste recovery; (IV and V) Carding and combing; (VI) Ring spinning; (VII) Ring spinning and doubling; (VIII) Ring doubling; (IX) Large packages; (X) Packages and doubling rings; (XI and XII) Electric driving; (XIII) General mill conditions; (XIV) The complete modern cotton spinning mill; (XV) Future spinning mills. C.

**Worsted Spinning Nomograph.** M. C. Bishop. *Text. World*, 1944, 94, No. 1, 74-75. A nomograph showing delivery rate and bobbin filling time is illustrated, and its working described. W.

#### (D)—YARNS AND CORDS

**Glass Fibre Yarns: Uses.** H. D. Keiser. *Amer. Inst. Min. Met. Eng., Tech. Publ.*, 1598, 14 pp.; *Min. Tech.*, 1943, 7, No. 3 (through *Brit. Chem. Physiol. Abstr.*, 1944, B I, 23). Brief descriptions are given, with flow-sheet diagrams of the processes used in making various types of glass fibre. The products are used in military and naval electrical equipment for insulating purposes, as retainer mats in storage batteries, as light-weight thermal insulation for aircraft, as a material for sound insulation in factories, for making fireproof insulating board for covering steel plating of decks, bulkheads, or hull, for the tension core of field telephone cable, for parachute flare shields, and for insulating steam pipes and refrigerators. C.

#### PATENTS

**Apparatus for Reclaiming Fibre from Wool, Wool Waste, etc.** F. Kershaw and H. F. Raisbeck. B.P.558,675 of 14/1/1944. The material is fed into the upper end of a sloping, reticulated cylinder and removed from the lower end, grease and dirt being thrown through the reticulations and then through a hopper to a sack. The cylinder has a side to side shaking motion, the degree of movement being adjustable to suit the requirements of the material being treated. A beater assists the passage of the grease and dirt by striking the hopper when the cylinder is rocked. W.

**Reclaiming Fibres from Wool, Wool Waste, etc.** F. Kershaw and H. F. Raisbeck. B.P.559,307 of 14/2/1944. The fibres to be reclaimed are blended with a mixture of dust and sand, and passed through a willeying and then a shaking machine. The dust absorbs grease and dirt and the sand also acts as a scavenging agent by forcing the grease and dirt-laden dust through the apertures of the willeying machine. The reclaimed fibres are suitable for re-use in the textile industry, and the cleansing medium is used as manure, having the advantage of being free from long fibre. W.

**Spindle Bearing Oil Extracting Device.** Fine Cotton Spinners' & Doublers' Association Ltd. and E. A. Leigh. B.P.560,214 of 15/10/1942:24/3/1944. A device for the extraction of oil from the spindle bearings of spinning, doubling, winding and similar textile machines comprises a cylindrical oil receiver having a removable cover provided with three apertures, one carrying a junction having a bent pipe for insertion into a spindle bearing, the second carrying an inlet pipe connected to a source of compressed air for producing a vacuum in the receiver, and the third aperture provided with a drain plug or tap through which the contents of the receiver can be discharged. C.

**Textile Disintegrating Machine Teasing Drum.** F. A. and Sophie S. von Osten (South Orange, N.J.). U.S.P.2,331,943. The teasing drum of a disintegrating machine comprises a shaft and end discs connected by a number of rods that carry pivotally mounted, rigid pins projecting beyond the side discs. C.

**Novelty Yarn Spinning Frame.** Goodall Worsted Co. U.S.P.2,332,395. A frame for producing novelty yarns comprises front and back rollers for drafting



roving at a uniform speed and thickness, means to impart twist, and a pair of feed rollers in front of the above front drafting rollers to deliver a novelty-producing strand under uniform tension, but at a different speed from that of the roving, to the point where twist is being inserted into the roving. C

**Covered Chenille Strand.** Duro Persian Manufacturing Co. Inc. U.S.P. 2,332,833. A strand of chenille is run through a constricting device to lay the outwardly-extending fibres at an angle and then wrapped in a covering of fibrous material (yarn). C.

**Spindle Brake.** Whitin Machine Works. U.S.P. 2,333,047. The claim is for a brake that applies pressure at opposite points of the whorl of a spindle and consists of a pair of levers actuated by a toggle device. C.

**Self-lubricating Spinning Ring.** Herr Manufacturing Co. Inc. U.S.P. 2,333,069. The claim is for a ring combined with a well from which a wick leads lubricant to the bearing surfaces of the ring, the special feature being the provision of an enclosure for the wick in the well. C.

**Glass Fibre Yarns: Production.** Owens-Corning Fiberglas Corporation. U.S.P. 2,333,267. A mat of glass filaments collected on a spinning drum is cut by angularly displaced knives into strips parallel to the axis of the drum and these are then stretched into yarns and collected. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Nylon Yarn: Preparation and Weaving.** E. I. Du Pont de Nemours & Co. *Textile World*, 1944, 94, No. 1, 67-68. Practical advice is given on the processing of nylon. In winding, it is best to use tension devices of the whorl or rotating drum types. The double weaver's knot is preferred. Sized and oiled yarns give much wider tension variations than sized but not oiled yarns, but oiled yarns have other advantages. Suitable dyes for tinting are listed; they have to be added to the size. Yarn is sized single end by means of an aqueous solution of polyvinyl alcohol, about 4.5 per cent. being added. Such yarn is sized again in warp form; the taping of unsized nylon yarn has not been widely developed. Satisfactory tension in pirn winding is 20-35 grams for sized 60-den. yarn; low-twist unsized yarn, requires lower tensions. Conditioning should take place first in a very moist atmosphere and then in a normal one. Steaming of pirns results in width changes at each weft change. Weaving is best at 50-70 per cent. R.H. Because of trouble due to static electricity all metal parts with which nylon makes running contact should be earthed. C.

#### (B)—SIZING

**Cotton Warps: Sizing.** Textile Operating Executives of Georgia. *Cotton (U.S.)*, 1943, 107, No. 12, 91-95. A more complete record of answers to a questionnaire than one already abstracted. C.

**Electronic Instruments: Application in the Textile Industry.** S. T. Herr. *Instruments*, 1944, 17, 30-32. Applications of the photo-tube, e.g. in the spectrophotometer which may be used for control purposes in dyeing, a photo-electric weft straightener, photo-electric switches for various purposes, and electronic circuits applied to pyrometers are mentioned. The control of moisture content in warp sizing is discussed and the Moist-o-graph is briefly described. When applied to a tape frame, a small metal contact roller rides on the warp at the delivery end of the machine. The grid element of the measuring circuit is connected to this control roller and is responsive to the current which can be passed through the warp from an independent low-voltage source. This current is a measure of the electrical resistance, and therefore the moisture content, of the warp. By providing the instrument with a set of control contacts, and the tape frame with a suitable variable-speed drive, it is possible to set the control point at any desired moisture content and the unit will automatically maintain this value by adjusting the speed as required. In order to obtain the maximum benefit from the Moist-o-graph the size preparation, size box temperature and level, and cylinder temperature or pressure should all be under automatic control. C.



**Nylon Yarn: Dressing for Knitting.** *Silk and Rayon*, 1944, 18, 315-316. A brief review is given of patented methods for the dressing of nylon yarn for knitting by means of polyvinyl alcohol (prepared by the hydrolysis of polyvinyl acetate), sometimes partially etherified by acid condensation with formaldehyde, and blended with boric acid. C.

**Gum: Use in Size.** N. A. Mukoseev. *Tekstil. Prom.*, 1943, No. 1/2, 23-24 (through *Chem. Abstr.*, 1944, 38, 647<sup>6</sup>). A textile size, equal or superior to the usual starch size, was made by replacing half of a 90-kg. batch of rye flour (in 700 l. of water) by 24 kg. of gum arabic, heating nearly to boiling, adding 4 l. of a solution of castor oil 16.5, oleic acid 2.5, 20° Bé. caustic soda 7.5 in water 23.5 kg., and further adding 1 l. of oleic acid, boiling 20 min., and neutralising with acetic acid. C.

**Lime: Use in Size.** V. Korolev and V. M. Rybakova. *Tekstil. Prom.*, 1943, No. 4/5, 12 (through *Chem. Abstr.*, 1944, 38, 647<sup>6</sup>). A satisfactory textile size was prepared by mixing 100 kg. of rye flour with 700 l. of water at 20-25°, heating to 40°, adding gradually 8 kg. of lime in 100 l. of water, and, after 10-15 min., heating nearly to the boiling point. C.

#### (C)—WEAVING

**Picking Bowl: Fixing.** *Cotton (U.S.)*, 1943, 107, No. 12, 89, 96. The question is raised why different methods are used to fasten the picking bowl on some (American) looms. In reply two authorities say that on older looms it was usual to hold the bowl only by the cover that is used to prevent splashing of oil on the warp, that on more modern looms an extra cap screw is provided on the end of the picking bowl stud, and that on the latest models of Draper looms the cover is not used, but an Alemite fitting is carried by the cap screw to provide for the lubrication of the bowl. C.

**Shuttle Accelerometer and Speedometer.** I. H. Thomas and J. J. Vincent. *J. Sci. Instruments*, 1944, 21, 45-48. Two instruments are described which measure the speeds and accelerations of moving bodies, e.g. shuttles. The accelerometer is a null instrument in which the force exerted by a weight freely supported in the moving body is balanced by a calibrated compression spring. The final result is given in units of g. The principle of the speedometer, of which the theory is given, is based on the fact that a helical spring, moving longitudinally with a mass attached to its leading end, will extend if the other end is suddenly stopped. The extension of the spring is directly proportional to the speed of the moving body immediately before it is brought to rest and is not appreciably affected by variations in some of the characteristics of the moving body. The instrument gives the speed directly in feet per second. C.

**Loom Accessories: Storage.** J. H. Morriston. *Cotton (U.S.)*, 1943, 107, No. 12, 83-85. Practical hints are given on the storage and record-keeping of loom supplies with suggestions about the emergency supplies that the tackler should hold in order to save time. C.

**Smallwares: Weaving.** A. Thompson. *Textile Manufacturer*, 1944, 70, 128-131. A report of a lecture on smallware weaving in the Derby district, with illustrations of Heywood, Hattersley twin-web, Matterson 12-web mock-space batten, and Clutsom and Kemp shuttleless looms. C.

**Towel Fabric Warps: Preparation.** O. Pomfret. *Textile Manufacturer*, 1944, 70, 11-12, 29, 68-70. A practical account is given of the usual and special methods and machines for preparing ground and pile warps for towels. C.

**Weaving Shed: Management.** Textile Operating Executives of Georgia. *Cotton (U.S.)*, 1944, 108, No. 1, 79-82; *Textile World*, 1944, 94, No. 1, 82-83. Replies from 17 mills to a set of ten questions on practical problems in weaving are analysed. On the question of suitable humidity, a table summarises the R.H. per cent. aimed at, with particulars of the range of cloths manufactured in each mill; the lowest R.H. is 65 per cent., and the highest 87½ per cent. Three records of temperature are 80-84, 85 and 90° F. C.

**Weaving Shed: Management; Checking Defective Work.** J. Middleton. *Cotton (U.S.)*, 1944, 108, No. 1, 67-69. The writer discusses tactful methods of fixing the responsibility for bad work and stresses the importance of proper training for those operatives who do the cleaning. Too often, this is regarded as a suitable job for the newest operatives. C.

**(D)—KNITTING**

**Flat Seam Looping Machine.** J. W. Hughes. *Cotton (U.S.)*, 1944, 108, No. 1, 123-126. The history of the looping machine for joining the edges of a knitted fabric with a flat seam is traced and detailed instructions are given for operating the "Sotco" machine. C.

**(G)—FABRICS**

**Knitted Underwear: Production.** N. Wonnacott. *Cotton (U.S.)*, 1942, 106, No. 4, 157-8; No. 9, 243-6. A general discussion of modern production methods in an underwear factory with details of the arrangement of machines and work sheets for the manufacture of a standardized type of knitted shorts. C.

**American Army Wind-resistant Sateen: Construction and Processing.** *Textile World*, 1944, 94, No. 1, 66. Suitable mill organization is suggested to meet the requirements of the wind-resistant 9-oz. sateen adopted by the American Army for field jackets, with or without pile-fabric lining. C.

**Machine Gun Cartridge Belt: Production.** J. A. Hendley. *Textile World*, 94, No. 1, 69-71. The development of fabric belting for machine guns is briefly reviewed. Very large quantities are now being made in the United States from  $1\frac{1}{2}$ - $1\frac{1}{8}$  inch cotton. Two plain or duck fabrics are woven simultaneously with most of the warp threads passing through each other at intervals to form the cartridge pockets. On the loading edge of the belt the warps do not cross for a width of  $\frac{1}{8}$  to  $\frac{1}{2}$  inch, so that a continuous V-shaped entrance to the pockets is secured. On the bullet side the warps cross twice as often as in the main part so that secondary pockets are formed between the cartridges, the bullets are more rapidly aligned and the loaded belt lies perfectly straight. The main fabric is woven from 12/4s yarn, 8 turns per inch, dyed olive drab; there are 156 ends in belts for 0.50 cartridges and 106 for the 0.30 calibre. The belt is reinforced with 6-end lockstitch cord, wet twisted and treated under tension to remove stretch; 12 ends are used for the 0.50 calibre and 4 for the 0.30 belting. There are 38 or 36 picks per inch of the 12/4s yarn. Structure diagrams are given and also hints on weaving. The best results are obtained by using large section beams and weaving 4-8 pieces from each beam. The belts are finished water- and mildew-repellent. Inspection tests are described. There should be 29 pockets per yard for the 0.50 belt and 33 per 24 inches for the 0.30 belt. When cut to length, each 25th pocket is numbered for the gunner's guidance. C.

**Nylon Monofilament: Application.** T. G. Joslin. *Textile Manufacturer*, 1944, 70, 136-137. A series of illustrations are given of recent developments in nylon yarn, "wire" and plastics. The monofilament or "wire" is used in a window screen material for the weaving of which a special loom is shown. C.

**Terry Towelling: Construction.** O. Pomfret. *Textile Manufacturer*, 1944, 70, 104-106. Tables are given of length and weight per piece, width, numbers and counts of yarns used, weave, and ratio of pile length to ground for typical sorts of (1) terry robings and bib and feeder cloths, (2) nursery squares, (3) rollerings, (4) cotton hand towels, (5) condenser pile hand towels, (6) linen and cotton/linen hand towels, and (7) bath mats. C.

**Inflatable Life Rafts: Design and Construction.** J. G. Kreyer. *Mechanical Engineering*, 1944, 66, 121-129. An account is given of the design and construction of inflatable life rafts and of the accessories and other equipment used with them. The laminated processed fabric used for the main tubes of the larger rafts comprises a rubber coating of  $2\frac{1}{2}$  oz. per square yard on the outside of a basket-weave fabric, a similar rubber coating on the underside of the fabric, followed by a light-weight plain-weave fabric placed on a bias, a rubber coating of  $3\frac{1}{2}$  oz. per square yard with another ply of plain-weave fabric, placed on straight, and an inside coating of 1 oz. per square yard. This combination has a thickness of 0.033 in. and a nominal weight of 19.3 oz. per square yard. The basket-weave fabric is constructed of plied yarns of long-staple combed cotton. The plain-weave fabric is woven from single yarns of long-staple combed cotton and has 120 x 120 yarns per inch. An alternative to the basket-weave fabric is a 5-shaft fabric constructed of plied yarns of long-staple combed cotton. Square-woven ducks are used for the bottoms, carrying cases and pockets of the rafts. When applying the rubber coating compound, not less than eight spreads or coats per ounce per square yard of surface covered are used. "Mae West" life vests are made of single-ply coated fabric. C.

**What is Tweed?** E. S. Harrison. *Wool Rec.*, 1944, 65, 456, 458, 460. A survey of the development of tweeds, with particular reference to the implications of the word, and the question of dyeing. The cloth is described—not defined—as of medium weight, not very smooth in texture, tending towards Cheviot qualities and to broken colour effects, and definitely limited to woollen yarn. W.

**Wool Cloth Measures and Weights.** "A.A." *Wool Rec.*, 1944, 65, 327. The present anomalies and discrepancies could be removed by generally adopting the standard measure of 36 in. to the yd. without allowance, and by quoting weight per sq. yd. W.

#### PATENTS

**Fully-fashioned Hosiery: Knitting.** A. T. May. B.P.559,926 of 13/10/1942: 10/3/1944. In the manufacture of hosiery, particularly fully-fashioned stockings, a running-on course comprising a series of spaced eyelet holes is provided at appropriate points in the fabric, e.g. at the edge of the foot portion. The holes are preferably formed by transferring a predetermined number of needle or sinker loops on to the adjacent needles. C.

**Winding Machine.** J. Mackie & Sons, Ltd. and J. P. Mackie. B.P.559,927 of 17/10/1942: 10/3/1944. A machine for winding yarn into cross-wound packages or cheeses is provided with a helically grooved roller which may either run in contact with the yarn package or cheese, or may be additional to the roller which drives the yarn package by contact, the said roller having two oppositely directed grooves in its surface leading toward the ends from near the middle of the roller, the grooves being entirely independent. One is a right-handed and the other a left-handed helix. A moving guide member gives a comparatively small lateral displacement to the yarn so as to offset, first toward one side and then toward the other, the point from which the yarn extends to the grooved roller, the displacement being sufficient to carry the yarn over the centre line of the grooved roller and to cause it to enter the groove leading to the opposite end of the roller, thus ensuring that the yarn shall engage with the starting end, first of the right-hand helix and then of the left-hand helix, with a view to effecting the traverse toward the end of the roller and back again under the central displacement or biasing action. It is convenient to effect the biasing movement by means of a continuously rotating roller with a single continuous groove in it extending diagonally first in one direction and then back again so that the whole motion may be communicated by rotating elements without the necessity for any reciprocating parts. The rotating guide may, however, be replaced by any suitable form of laterally moving guide eye if preferred. C.

**Knitting Machine Yarn-control Device.** B. Toone (Nottingham) Ltd. and R. N. Toone. B.P.559,952 of 25/8/1942: 13/3/1944. A knitting machine having a yarn feeder displaceable between feeding and non-feeding positions, is provided with a yarn-control device located at the plain side of the needles to receive a withdrawn yarn on movement of the feeder to non-feeding position and to place the yarn for re-introduction to the needles on movement of the feeder to feeding position. The device may be applied to splicing and other mechanisms whereby a yarn is introduced into the fabric at intervals. C.

**Winding Machine Bobbin-identifying Apparatus.** Universal Winding Co. B.P.559,958 of 9/9/1942: 13/3/1944 (Conv. 11/9/1941). A winding machine is provided with a bobbin-identifying apparatus designed to apply an identification ticket automatically to a bobbin in such a position that the ticket is held in place by the yarn wound on the bobbin. The operating means are preferably arranged to actuate the ticket-supplying mechanism in timed relation to the winding operation of the bobbin. An electromagnet may be provided for operating the ticket-supplying mechanism and automatically controlled means may be arranged to control the energisation of the electromagnet. The identifying ticket may be applied to the bobbin from a continuous strip of tickets and the ticket-supplying mechanism is then preferably situated adjacent to the bobbin and is arranged to advance the ticket-strip to place a ticket between turns of the winding yarn to cause it to be gripped thereby with an end projecting from the bobbin. C.

**Snag-resistant Polyamide Knitted Fabrics: Production.** E. I. Du Pont de Nemours & Co. B.P.560,084 of 26/5/1942: 20/3/1944 (Conv. 14/2/1941). A method for the production of sheer knit goods, substantially free from snags

and pulled threads, from water-insensitive, continuous-filament, synthetic linear polyamide yarns, comprises applying an aqueous dispersion of a film-forming material which is tacky in the air-dried state, e.g. an alkyd resin, vinyl interpolymers, natural resin or a carbohydrate. With acidic resinous materials that are insoluble in water, dilute alkalis may be used to effect solution. In some cases it may be desirable to add a certain proportion of a water-miscible organic solvent to aid solubility and accelerate drying. C.

**Knitting Machine.** H. N. Smith and Elizabeth E. Smith (Daventry). B.P. 560,192 of 11/8/1942:23/3/1944. A knitting machine comprises looping means, a series of loop guard members and a series of new loop accepting members, the looping means being operable to form new loops through first one and then another of a course-wise series of previously formed loops on the guard members, each looping movement taking place relatively to a guard member which holds open the loop being penetrated, the accepting members being arranged to receive the new loops and the machine being so constructed and arranged to operate that the old loops are released from the looping means and transferred by relative movement between the co-operating guard and accepting members from the accepting members to the guard members in turn to be held open for new loops to be formed through them by the looping means. The guard members may be arranged to receive the new loops from the same side as such loops were accepted by the accepting members. This construction lends itself to a modification whereby two pieces of fabric may be knitted in the machine which may be joined at either or each end, in the first case to produce a single double width piece and in the second case a tubular fabric. The transfer of loops by the relative movement between the guard and accepting members may be aided by means co-operating therewith to keep the loops squarely related to the guard members during the transfer operation. The part of the guard member holding the loops is preferably a channel open at each end and the accepting member is received in the channel while the transfer occurs. C.

**Cop Winding Machine.** J. Mackie & Sons Ltd. and J. P. Mackie. B.P. 560,267 of 30/10/1942:28/3/1944. In mechanism for forming cops with tapered nose ends, a grooved roller is used for traversing the yarn over the nose of the cop, the roller is driven by the drag of the yarn in its groove, and is mounted so as to be retracted when required to facilitate starting of the winding, or piecing-up any broken ends of yarn, and to be returned to its correct position for winding purposes. The roller is constructed in two parts suitably fitted together and providing the guiding groove for the yarn between their opposing faces. C.

**Mock-fashioned Stocking: Production.** C. J. Toon and J. Toon & Sons Ltd. B.P. 560,312 of 20/1/1943:29/3/1944. A method of making a mock-fashioned stocking comprises the steps of knitting on a seamless knitting machine a length of tubular material comprising leg, ankle and foot parts, flattening the tube, cutting the foot part so as to provide a heel part and a strip of the material which is narrower than the tube and extends below the heel part, folding the strip back upon itself inwardly towards the heel part, attaching the then adjacent longitudinal edges of the strip to each other, and attaching the bottom edge of the strip to the then adjacent edges of the heel part so as to provide the instep, the toe and the sole of the stocking. In a preferred method, a seamless tube equal to the length of two stockings is knitted upon a tubular knitting machine and, during the knitting operation, the central part of the length of the tube of knitted material is automatically tightened in order to form the ankle and foot parts of the two stockings. After removal from the machine the knitted tube is flattened and cut so that it is separated into two lengths, each forming one stocking length and each comprising a narrow strip adapted to form the instep, toe and sole of the foot. Preferably the stocking is provided with an imitation seam at the back of the leg and with imitation fashion marks on opposite sides of the seam. It is also preferred to form a welt at the end of the stocking length of material during the knitting operation. C.

**Picker Stop.** Draper Corporation. U.S.P.2,332,366. The claim is for an adjustable element that bears against the top surface of the slay when engaged by the picker at a predetermined point of its travel. C.

**Reinforced Flexible Transparent Sheeting.** E. I. Du Pont de Nemours & Co. U.S.P.2,332,373. An open-mesh material made of nylon monofil is coated with a film of ethylene polymer, heated to the fusion point of the polymer, and rapidly cooled by quenching in a cooling liquid. C.

**Resilient Yarn Stockings: Knitting.** Paramount Textile Machinery Co. U.S.P.2,332,738. Stockings are knitted under low tension from a resilient yarn that resists the formation and retention of loops by feeding the yarn to the machine in intimate contact with a controlling yarn and afterwards removing this yarn. C.

**Rayon Winding Machine Thread Guides.** American Viscose Corporation. U.S.P.2,332,889. The claim is for a device for guiding the thread in the unwinding of a sequence of yarn packages so that when the trailing end of one package is united to the leading end of another the loop of joined thread may be kept out of the region of ballooning. C.

**Knitting Machine Fabric Draw-off Mechanism.** Textile Machine Works. U.S.P.2,333,074. The claim is for self-locking mechanism that engages by a downward movement with the fabric-engaging element without interference with the knitting frame. C.

**Moulded Plastic Bobbin.** Kilgore Manufacturing Co. U.S.P.2,333,340. The claim is for a bobbin moulded from a coloured plastic with stout ratchet teeth at either end. C.

**Textile Machine Batten: Reinforcing.** C. L. Huffman (Greenville, S.C.). U.S.P.2,333,377. A wood element for textile machinery that acts as a lever about a pivot is reinforced on either side of the hole in it by cutting diagonal bolt holes and filling them with dowel pins. C.

**Shuttle Weft Guard.** J. B. Daudelin and R. J. Messier. U.S.P.2,333,413. The claim is for a device located in the throat of the shuttle to stop an outwardly running balloon as the weft runs through the threading slot to the delivery eye. C.

**Circular Knitting Machine Adjustable Combination Stand.** Tompkins Bros. Co. U.S.P.2,333,572. A number of stands are mounted on a support that extends about the axis of the needle cylinder and are adjustable as a unit both radially and circumferentially. Slide means interconnecting the stands make some of them independently adjustable. C.

**Knitted Vulcanized Composite Fabric: Production.** Vanity Fair Mills, Inc. U.S.P.2,333,630. A base sheet containing latex is knitted through and then vulcanized. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

(B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Cottonin: Effect of Processing on Structure.** K. C. Menzel. *Klepszig's Textil-Z.*, 1943, 46, 4-9 (through *Chem. Zentr.*, 1943, i, 2257 and *Chem. Abstr.*, 1944, 38, 873<sup>1</sup>). The surface structure of the cottonin obtained from green tow by chemical disintegration is related closely to the degree of disintegration and greatly affects the spinning properties. It is affected appreciably by the presence of residues of the material that originally surrounded the fibre bundles and also by the condition of the middle lamella. The impurities of the tow from flax are attacked readily by alkali; those of tow from hemp, less easily. The cottonin can be improved greatly by thorough washing after the alkali treatment. The spinning properties of cottonin are damaged by bleaching. Acid pre-hydrolysis attacks the materials accompanying the cellulose, and occasionally causes the green tow to stick together. Acidification after the alkali boiling lightens the goods and improves the feel. Correct brightening makes the cottonin soft and flexible. Good cottonin can be produced even from raw material which is not very clean if the pre-cleaning, alkali disintegration, washing, brightening and mechanical after-treatment are well co-ordinated. C.

**Saponins as Detergents.** W. Kind. *Fette u. Seifen*, 1942, 49, 708-711 (through *Chem. Abs.*, 1943, 37, 6371). Saponins of various origin used in washing experiments on woollens and coloured goods failed to show any cleaning effects. W.

**Saponin as Textile Assistant.** H. J. Henk. *Zellwolle, Kunstseide, Seide*, 1942, 47, 131 (through *Chem. Abs.*, 1943, 37, 5870). The cleaning properties of saponin are due to negative electrostatic charges that peptize the dirt particles. The addition of 0.5-1.0 per cent. saponin to benzine prevents auto-ignition. W.

#### (G)—BLEACHING

**Continuous Peroxide Bleaching Range: Advantages.** W. W. Chase. *Textile World*, 1944, 94, No. 1, 76-78. A description is given of a new plant for continuous peroxide bleaching in open width, installed at the Riverside and Dan River Cotton Mills, Virginia. The units are (1) the cloth trolley, (2) a mangle for saturating the cloth with caustic soda, (3) a vertical heating tube, (4) a J-box, (5) a vertical washer, (6) an acid tank and mangle, (7) a vertical washer, (8) a travelling lattice, (9) a peroxide tank and mangles, (10) and (11) duplicates of (3) and (4), (12) and (13) two vertical washers, (14) drying cans, and (15) a winder. The treatment for an 8½-oz. herringbone twill and similar fabrics is outlined. The cloth travels at 50-60 yards per minute and the whole passage (including the piling in the J-boxes, which hold about 5400 yards) occupies about 2 hours 40 minutes. Costs for chemicals used are about 1.50 to 2 dollars, and the steam consumption is less than 750 lb. per 1000 lb. of cloth. C.

**Cellulose Fibres: Acid Bleaching.** P. P. Viktorov. *Tekstil. Prom.*, 1943, No. 1/2, 18-22; No. 3, 12-15 (through *Chem. Abstr.*, 1944, 38, 646<sup>9</sup>). Steep the material in water at 50-60°, after 36 hours wash with water at 50-60°, steep in a solution of sulphuric acid (5 g. per l.) at 60° for 12 hours, wash with water until neutral to Congo red, steep in a soap solution at 110-120° for 8 hours, drain and wash with circulating hot water for 30 min., wash twice with cold water, and treat with hypochlorite as usual. This process is particularly applicable to gauze. To prepare absorbent (hospital) cotton, heat for 4 hours in a sulphuric acid solution (0.5 g. per l.) with or without a wetting agent, wash with water, treat for one hour at ordinary temperature with an acid hypochlorite solution containing 1 g. per l. of active chlorine, rinse in water, bleach for one hour in an alkaline hypochlorite solution containing active chlorine 2 and silicate 2 g. per l., total alkalinity 0.5-0.8 g. per l., heating gradually from 30° to 60°, rinse with water, acidify with sulphuric acid (3-5 g. per l.), wash and dry at 50-60°. Some modifications of this procedure are discussed. C.

**Fur Bleaching.** W. E. Austin. *Text. Col.*, 1943, 65, 407-411, 429-430, 472, 519-521. A special technique is required on account of the diverse properties of skin and hair, and because an intense natural colour often has to be removed. Sulphites are used to bleach light-coloured furs by reduction, while pigmented furs are usually bleached by oxidation with peroxides. Solutions are applied by the brush or dip methods, ageing, drum bleaching (using an absorbent) or solvent bleaching. Deeply pigmented furs are best bleached catalytically with peroxides. The principles and mechanism of catalytic fur bleaching are discussed, and the methods of application described, the essential steps being "killing" (to remove grease and swell the fibres), application of the catalyst, bleaching and after-treatments. W.

#### (I)—DYEING

**Cotton Pile Fabrics: Dyeing.** *Textile Weekly*, 1944, 33, 407-9, 563-566. A general, practical account is given of the dyeing of cotton pile fabrics with direct, sulphur, vat, and basic dyes. C.

**Nylon Yarns and Fabrics: Dyeing.** E. B. Abbott. *J. Soc. Dyers & Col.*, 1944, 60, 55-59. The principal dyeing and fastness properties of dispersed dyes when applied to nylon are reviewed and compared with the properties of the dyes when applied to cellulose acetate rayon. The selection of dyes to be used in mixtures is discussed. The use of Solacet dyes for nylon is also discussed and differences in the behaviour of these dyes towards nylon and cellulose acetate rayon are described. The effects of certain physical properties of nylon on its behaviour in large scale dyeing are pointed out. C.

**Nylon Yarns and Fabrics: Dyeing and Printing.** *Silk and Rayon*, 1944, 18, 318. Brief particulars are given of new methods for dyeing nylon, including the use of formaldehyde sulphonylate in vat dyeing (B.P. 534,085; Imperial Chemical Industries Ltd.) and the reservation of nylon against direct dyes by means of sulphonic acid compounds (B.P. 552,015; I.C.I. Ltd.). C.

**Soap Solution: Dye Solubilization and Colloidal Micelle Content.** J. W. McBain and K. E. Johnson. *J. Amer. Chem. Soc.*, 1944, **66**, 9-13. The solubilization of insoluble dye by four potassium soaps containing 8-14 C atoms has been measured for equilibrium conditions over a range of concentrations. The solubilization increases so rapidly with the higher soaps as to cast doubt upon the suggestion that it is solution in the hydrocarbon fraction of the molecule and to favour the view that it involves incorporation between the layers of lamellar micelles. Potassium chloride not only greatly increases the solubilizing power of fully-formed micelles, but it produces in dilute solution micelles of still higher solubilizing power. C.

**Sodium Alkyl Sulphates: Adsorption by Fibres.** R. G. Aickin. *J. Soc. Dyers & Col.*, 1944, **60**, 60-65. The adsorption of sodium alkyl sulphates by wool has been studied under a variety of conditions. The single long-chain alkyl sulphate ion reacts with the basic groups present in wool and behaves as a colourless dye, in that the adsorbed ions cannot be removed by a simple washing process. Quite large amounts of the sodium alkyl sulphates are adsorbed, viz., up to 2.5 per cent. on the weight of the fibre, under neutral conditions. The extent of the adsorption increases with increasing H-ion concentration, and the concentration of the sodium alkyl sulphate solution is reduced almost to zero if there is less present initially than corresponds to the acid-combining capacity of the wool. The retarding and levelling action of these compounds in dyebaths can be explained in terms of this adsorption, since the dye sulphonic acids and the alkyl sulphates are competing for the same basic groups in the wool fibre, or active centres in other fibres. The extent and rate of adsorption are increased by the addition of electrolytes, the ion of sign opposite to that of the long-chain ion being responsible. As with interfacial tensions, the univalent ions fall into a lyotropic series. Measurements have also been made of the adsorption of sodium alkyl sulphates by cotton, silk, deaminated wool and nylon. The extent of the adsorption depends largely upon the number of basic groups present in the fibre. The curve for the adsorption by cotton is of the same shape as that for the adsorption by wool, showing that it is the single long-chain ion which is involved in both cases. With wool the adsorption increases over quite a long period, but with cotton it is complete in less than 30 minutes. The mechanism of adsorption thus appears to be different in the two cases. C.

**Luminescent Pigments: Characteristics.** G. F. A. Stutz. *Paper Trade J.*, 1944, **118**, TAPPI, 78-80. Fluorescent and phosphorescent pigments and their uses, and exciting light sources for these pigments are discussed. The chemical properties, daylight colour, fluorescent colour and brightness, afterglow, and other characteristics of fluorescent zinc and cadmium sulphides, the luminescent pigments that have found most use in printing inks, coated papers and filled papers, are briefly described. C.

**Peat, Brown Coal and Alder Bark Dyes: Application.** S. A. Bensman and G. N. Proshkin. *Legkaya Prom.*, 1943, No. 1/2, 12 (through *Chem. Abstr.*, 1944, **38**, 645<sup>6</sup>). Alkaline extracts of granulated peat gave dyeings on cotton that were not fast. Treatment of the dyed fabric for half an hour at 40-50° in a solution containing 1 per cent. of sodium dichromate and 2 per cent. of 30 per cent. acetic acid, and a 1 per cent. solution of copper sulphate removed part of the dye, but the remaining part was quite fast. Lignite extracted with boiling 40° Bé. caustic soda for 4-5 hours, filtered, and diluted with water, and applied to fabric which was then washed with acidified water and treated with dichromate solution, gave better results than did the peat extract. Caustic soda extract of alder bark was applied to cotton with a little ferrous sulphate, and to wool with ferrous sulphate and size. The cotton was dyed gray and the wool green-black. By using various metal salts there were obtained beige, brown, olive, black and other colours. Detailed experimental data are given. C.

**Aniline Black Dyeings: Production.** (1) B. V. Ponomarenko and A. A. Veliksel'skaya. (2) I. M. Khailov and E. A. Kondratenko. *Khlopchatobumazhnaya Prom.*, 1940, No. 11-12, 45-49 (through *Khim. Referat. Zhur.*, 1941, **4**, No. 7-8, 107-108 and *Chem. Abstr.*, 1944, **38**, 868<sup>5</sup>). (1) It has been proposed to add an excess of aniline to increase the mechanical strength of the dyed fabric on the assumption that free aniline neutralizes mineral acid.



Another view is that all free aniline evaporates during the dyeing process and, therefore, does not affect the strength of the fabric. Fabrics were dyed with aniline black dyes and the colour effect, the mechanical strength of the fabric and the concentrations of aniline in the air and in the drier, depending on the percentage of free aniline, were determined. Increasing the amount of free aniline in the bath caused increased volatilization of aniline, but did not improve the fabric. The limiting permissible content of free aniline is 5 per cent. (2) In dyeing cotton, in order to avoid as much as possible weakening of the fabric, and to produce a better colour, it is recommended to use aniline salt 10, copper sulphate 1, potassium dichromate 10 per cent. and the theoretical amount of hydrochloric acid required to displace dichromic acid from K dichromate; the temperature should be 20-25° and time of dyeing 1 hour. A preliminary treatment of the yarn with 0.5 per cent. solution of *p*-phenylenediamine is recommended. C.

**Dyed Silk: Treatment to Increase Fastness.** K. M. Markuze. *Shelk*, 1940, No. 12, 20-1 (through *Khim. Referat. Zhur.*, 1941, 4, No. 7-8, 108 and *Chem. Abstr.*, 1944, 38, 871<sup>3</sup>). The substantive and some neutral-dyeing acid dyes produce on silk fast colours in light and medium shades, but less fast colours in dark shades. Fastness can be improved by treatment with a condensation product of formaldehyde and dicyanodiamide. The method increases fastness to washing, does not decrease the light fastness, and leaves the shade almost unchanged. Treating rayon fabrics with the condensation product decreases their light fastness. C.

**Indanthrene Dyes: Application.** K. Stierwaldt. *Deut. Färber-Ztg.*, 1943, 79, 1-7 (through *Chem. Zentr.*, 1943, 1, 1719 and *Chem. Abstr.*, 1944, 38, 869<sup>8</sup>). A discussion of the classification of these dyes according to their absorption velocities, migration properties and levelling powers; newer dyeing methods, as the dyeing at 80-90°, dyeing in temperature stages with initial temperatures of 16-17° with the use of wetting agents, such as Igepon T or TS, Peregol OK, Humectol CX or Setamol WS; the pigment padding method with the use of an assistant, such as Eulyisin A; acid vat dyeing methods, etc. C.

**Substantive Dyeings: After-treatment with Chromium Salts.** G. Nitschke. *Textilberichte*, 1943, 24, 189-191 (through *Chem. Abstr.*, 1944, 38, 646<sup>4</sup>). Certain substantive dyeings can be improved in fastness by an after-treatment with dichromate and formic acid. This improvement is due to the power of formic acid to reduce Cr<sup>VI</sup> compounds partly to activated Cr<sup>III</sup> compounds. This after-treatment is applicable to substantive dyeings of staple fibre and cotton as well as to dyeings on semi-wool and wool-staple fibre mixtures; it can be employed in a two-bath or one-bath process. C.

**Sulphur Dyes: Application; Determination of Optimum Quantities of Sodium Sulphide.** N. N. Voznesenskiĭ and N. K. Sokolova. *Tekstil. Prom.*, 1943, No. 3, 8-11 (through *Chem. Abstr.*, 1944, 38, 646<sup>5</sup>). For sulphide determination the plumbate and the potentiometric methods are preferred to the iodometric. The plumbate method used with sodium ferrocyanide as external indicator is simple and reliable. The sodium sulphide requirements are different for various sulphur dyes and also depend on whether the dye is a powder or a paste and on the way it was stored. C.

**Dyes: Fading.** A. N. Terenin. *Trudy Chetvertogo Soveshchaniya Voprosam Anilinokrasochnoi Khim. i Tekhniki* (through *Khim. Referat. Zhur.*, 1941, 4, No. 9, 16 and *Chem. Abstr.*, 1944, 38, 871<sup>4</sup>). Precision physical methods are necessary for the complete explanation of the individual stages of the fading process. In a number of cases the application of the photochemical method explained the individual steps of the fading process. Fading is not a chain reaction; the retardation of fading by inhibitors is caused by the decomposition of the peroxide compound formed by the dye. C.

**The Dyestuff and Chemical Industry of Germany.** A. M. Ryde. *Dyer*, 1943, 89, 85-87, 125-127, 165-166, 173, 201-202, 239-241, 277-278, 309-310, 347-348, 387-388, 423-425, 457-458. A review of the growth and development of the German chemical industry, with particular reference to the activities of the I.G. Farbenindustrie A.-G. W.



**(J)—PRINTING**

**Chitin: Use in the Textile Industry.** P. P. Viktorov and I. M. Maïofis. *Khlopchatobumazhnaya Prom.*, 1940, No. 11-12, 52-53 (through *Khim. Referat. Zhur.*, 1941, 4, No. 7-8, 108 and *Chem. Abstr.*, 1944, 38, 874<sup>3</sup>). Chitin obtained from crab shells was deacetylated by treating 200 g. with 1000 c.c. of caustic soda (50° Bé.) at 120°, decanting the caustic soda, pressing out, washing and drying at 60°. The yield of chitosan was 90 per cent. Its highly viscous, colourless solution in acetic acid can be used as a thickener for printing and for finishing various fabrics. Chitosan solution is not washed from the fabric by alkali solution. C.

**Stencil-printing Frames: Cleaning.** A. Franken. *Deut. Textilwirt.*, 1942, 9, No. 17-18, 27 (through *Chem. Zentr.*, 1943, 1, 1001 and *Chem. Abstr.*, 1944, 38, 370<sup>9</sup>). Frames fitted with phosphor bronze gauze are cleaned with a solution of 1:1 caustic soda of 40° Bé. For silk gauze a solution of 3 c.c. of the same caustic soda per l. is used first and then a bath is used containing 4 g. of Biolase N extra powder, 1 l. of water (70°) and 0.5 g. of Nekal BX dry or else the bath contains 4 g. of Vival E conc., 1 l. of water (50°), 0.5 g. sodium chloride and 0.5 g. Nekal BX. The washing periods for these baths is 3 hours and the washing is repeated, if necessary. The chromium gelatin can be dissolved also with lactic acid. In all cases the frames must be rinsed thoroughly. C.

**(K)—FINISHING**

**Permanent Waving Preparations.** C. H. Allen. *Soap, Perfumery and Cosmetics*, 1943, 16, 392, 394, 397-8 (through *Chem. Abs.*, 1943, 37, 6088). Formulae are given illustrating the use of ammonia, ammonium carbonate, potassium carbonate, sodium carbonate, borax, monoethanolamine, triethanolamine, morpholine, ammonium sulphite, sodium sulphite, potassium sulphite, ammonium acetate, calcium oxide, calcium carbonate, ammonium sulphate, oxalic acid, barium chloride, copper carbonate, aluminium powder, potassium chlorate, copper sulphate, sodium chlorate, and a heat indicator of the mercuric iodide and cuprous iodide type. W.

**(L)—PROOFING**

**Electronic "Sewing" Machine: Application.** C. N. Hoyler. *Plastics Resins Ind.*, 1943, 1, 8 (through Mark & Proskauer's, *Resins, Rubber, Plastics Abstr.*, 1943, Sheet 680). An experimental electronic sewing machine is shown in which thermoplastic material to be bonded is advanced by a pair of rotating electrodes and exposed to a strong field for a few hundredths of a second. Very little power is required, e.g. two sheets of Vinylite, 0.004 in. thick, may be bonded in a seam  $\frac{1}{8}$  in. wide, at an inch per second with less than 10 watts. To accomplish the same result, two heated rollers would require a temperature of 180° C., and one roller operated over a platen would require a temperature of 370° C. In the electronic machine the heating is very uniform, and the heat conductivity of the electrodes keeps the outside of the material relatively cool so that the highest temperature is in the central part where bonding is supposed to take place. Devices for binding, hemming, or folding operations can be attached to the machine. For sealing packages, bar electrodes may be used. C.

**Copper Soaps: Rot-proofing Action.** P. B. Marsh, G. A. Greathouse, Katharina Bollenbacher and Mary L. Butler. *Ind. Eng. Chem.*, 1944, 36, 176-181. The results of soil burial tests show that copper naphthenate prevents rotting of cotton fabrics at lower concentrations than do copper oleate, "tallate" or hydrogenated resinate. Of these four soaps, copper naphthenate alone is able to prevent the growth of the copper-tolerant fungus *Aspergillus niger*. Naphthenic acid is effective in preventing the growth of *Aspergillus niger*, *Penicillium* sp., *Chaetomium globosum*, and *Metarrhizium* sp., and in preventing fabric deterioration in soil. Tall oil, oleic acid and hydrogenated resin show no protective value in any of these cases. Fabric treated with copper naphthenate, which has been drastically leached with dilute nitric acid until essentially free from copper, still has enough residual protection to prevent growth of *Aspergillus niger*; it is likewise protected against deterioration in soil. These facts indicate that the high preservative power of copper naphthenate is due in part to naphthenic acid. Fabrics treated with copper oleate, naphthenate and tallate lose copper readily at the points where the fabric is in contact with soil. Each of these compounds is insoluble in water, but may be solubilised by

acid hydrolysis or by reaction with materials which form soluble copper complexes. A neutralised sodium hydroxide extract of soils will dissolve copper from treated fabrics. Neutralised solutions of a variety of naturally occurring hydroxy and amino acids have a similar effect. Copper hydrogenated resinate is highly resistant to leaching. Its relatively poor protective power in contact with soils may be due in part to the low availability of ionic copper. C.

**Ozokerite: Use for Waterproofing.** N. P. Batsyn. *Tekstil. Prom.*, 1943, No. 4/5, 15 (through *Chem. Abstr.*, 1944, 38, 647<sup>b</sup>). Stearin, paraffin and aluminium oxide usually used for waterproofing were successfully replaced by ozokerite, waste fat and ferrous sulphate. An emulsion was prepared from ozokerite 150, waste fat 100, 32.5 per cent. caustic soda 16-20, 25 per cent. ammonium hydroxide 15-20 and water 180 g. Details of the application of the emulsion and the subsequent ferrous sulphate treatment are given. C.

#### PATENTS

**Wool: Chlorine Gas Treatment for Unshrinkability.** J. Brandwood. B.P. 559,263 of 11/2/1944. Wool, or similar fibre, in the form, e.g. of rovings or yarns, is wound into packages which are mounted on perforated holders of metal, metal alloy or other chlorine-resistant material, and subjected to the action of chlorine gas; the packages are cleared of residual gas by compressed air, and then washed. The winding is done so that a thin, even and permeable layer is presented to the gas. The gas (1-3 per cent. of the weight of the material, according to the degree of unshrinkability required) is preferably mixed with a large proportion of air at 5 lb./in. pressure. The apparatus used is similar to a yarn dyeing apparatus. Initial drying of the fibres is unnecessary; they may contain about 40 per cent. moisture. W.

**Wool Mixture Materials: Treatment to Reduce Shrinkage.** J. B. Speakman, T. Barr and Imperial Chemical Industries Ltd. B.P. 559,787 of 21/8/1942: 6/3/1944. A process for the treatment of loose fibre, yarn, or woven or knitted fabric consisting of or containing wool fibres to produce effects which include an increased stiffness, a reduced affinity for water vapour, and a reduced tendency to felt or, for woven or knitted fabrics, to shrink, comprises exposing the material at elevated temperature, but below 100° C., to the combined action of water vapour and the vapour of a volatile monomeric vinyl or vinylidene compound, e.g. an ester of acrylic or methacrylic acid, styrene or a vinyl ester, the temperature, time and other conditions of the treatment being such as to cause substantial polymerisation of the vinyl or vinylidene compound within the fibre. If the material is wetted out with water before exposure to the action of the mixed vapours, more even effects are obtained. If a polymerisation catalyst is required, the material may be impregnated with an aqueous solution of the catalyst. C.

**Fabrics: Coating.** Texproof Ltd. and R. H. Czczowitzka. B.P. 559,820 of 19/6/1942: 9/3/1944. A process of surface coating fabrics with a composition containing a polymerised organic compound, comprises first impregnating the fabric with a volatile liquid to form an emulsified layer of the composition at the surface of the material, which minimises permeation of the material by the coating composition, coating the material with a composition containing a polymerised organic compound, and drying the coated material. The impregnating liquid may contain small quantities of substances that modify its viscosity and wetting power, and also a precipitant for the coating composition. C.

**Transfer Marking Composition.** British Kaumagraph Transfers Ltd. B.P. 559,859 and 559,878 of 31/8/1942: 8/3/1944 (Conv. 17/9/1941). (1) A dye composition or transfer marking composition suitable for application to cotton, wool, silk or nylon fabrics comprises a dye, a non-resinous compound or compounds containing singly or collectively a phenolic group and a carboxylic group and capable of acting to fix the dye in the fibres of the fabric upon application of heat and in the absence of moisture or steam, together with a resin and/or a wax. The dye may be of the group Nigrosine base 2R, Methyl violet base, Rhodamine bases, Victoria blue base, Crystal violet. Salicylic acid is a satisfactory fixing or assisting agent. If desired a plasticiser, such as an alkyl phenol, may be added to the resinous material. (2) A heat transfer consists of a paper backing and a transfer marking composition printed thereon, the marking composition comprising a dye, an assisting agent or agents, namely, a com-

pound or compounds containing singly or collectively a phenolic group and a carboxylic group, and resin or wax or both resin and wax, the composition being capable of being released from the backing and caused to adhere to a textile fabric upon application of pressure at an elevated temperature below  $250^{\circ}\text{C}.$ , and the dye being capable of becoming fixed on the fibres of the fabric under the influence of the heat and pressure and of the assisting agent or agents, and while maintaining the composition in a dry state. C.

**Nylon Fabrics: Dyeing and Printing.** British Kaumagraph Transfers Ltd. B.P. 559,879 of 31/8/1942:8/3/1944 (Conv. 17/9/1941). A method of dyeing fabrics and articles containing nylon or other fibres comprises applying by dry heat and pressure, at a temperature less than about  $250^{\circ}\text{C}.$ , a composition containing a dye and a fixing agent. In order to facilitate printing it is preferable to include a resinous material and/or a wax as an ingredient of the composition. If the dye composition is to be used as a transfer composition, a wax is added. The fixing agent may be salicylic acid, or a phenol, together with a carboxylic acid. The dye may be of the group including Nigrosine base 2R, Methyl violet base, Rhodamine bases, Victoria blue base and Crystal violet. C.

**Anti-gas Clothing.** British Cellophane Ltd., G. S. Heaven and Zoe Heaven. B.P. 559,966 of 9/9/1942:14/3/1944. An article of clothing resistant to the passage of toxic materials including liquids and mists, such as mustard gas, consists essentially of two outer layers of leather or one outer layer of leather and one of fabric showing relatively low resistance to penetration by toxic material and between them a continuous interlayer of impervious sheet cellulose. The outer layers are united together around their edges to form a pocket, but are not united to the interlayer, which can be removed and replaced as desired. C.

**Rubber Bonded Cotton Fabrics: Production.** United States Rubber Co. B.P. 559,986 of 2/11/1942:14/3/1944 (Conv. 8/11/1941). A process for bonding rubber to plies of fabric containing cotton for the production of tyre casings, hose pipes, belting, etc., comprises applying to the fabric a coating of an aqueous rubber dispersion containing a quaternary ammonium compound in which one valency of the nitrogen is satisfied by an anion and the remaining valencies are satisfied by hydrocarbon radicals, drying the coating, applying a vulcanisable rubber composition, and vulcanising the composite structure. The anion of the quaternary ammonium compound may be any common ion, such as that of the hydroxide, halide, formate, acetate or sulphate radical. Specified quaternary ammonium compounds include benzylpyridinium chloride, trimethylbenzylammonium hydroxide and tetraethylammonium chloride. Tests have shown that the use of small amounts of these compounds in the manner described leads to a substantial increase in the flexible resistance of the rubber-fabric product. C.

**Cellulose Acetate Materials: Acid Dyeing.** D. M. Clark (Atlantic Rayon Corporation, Providence, Rhode Island, U.S.A.). B.P. 559,991 of 22/5/1941:15/3/1944. Secondary cellulose acetate, in the form of yarn, fabrics, films, etc., is dyed by treatment with an acid dye in an aqueous solution of an organic solvent of the cellulose acetate, e.g. formic or acetic acid, having a  $\text{pH}$  value below 1.4. The solution has a concentration between, on the one hand, the threshold concentration at which wetting and penetrating capacity toward the cellulose acetate become markedly greater than that of water, and, on the other hand, either the critical delustering concentration or the critical swelling concentration for the particular time and temperature conditions employed, and, if necessary, an inorganic acid is added to depress the  $\text{pH}$  value below 1.4. C.

**Printing Paste.** Hercules Powder Co. B.P. 560,049 of 5/12/1940:17/3/1944 (Conv. 10/2/1940). A textile printing paste has a total solids content not much above 20 per cent. by weight comprising a water-insoluble colour pigment dispersed in an emulsion comprising a continuous phase consisting of a solution of an insoluble cellulose ether in a volatile organic solvent and a discontinuous aqueous phase, the content of solids derived from the emulsion not exceeding about 10 per cent. by weight of the paste. If desired, a plasticizer for the cellulose ether or a suitable synthetic resin, or both, may be included in the solution of the cellulose ether. The printing paste may be applied to fabric by means of printing rollers or screens and the printed material dried at a temperature in

the range of 180° F. to 320° F. Development of the colour in the fabric and washing and soaping are not necessary. C.

**Thermoplastic Organic Materials: Heating by High Frequency Electric Fields.** E. I. Du Pont de Nemours & Co. B.P.560,101 of 14/9/1942:20/3/1944 (Conv. 13/9/1941). A process of inducing heat in thermoplastic organic materials comprises incorporating crystalline titanium dioxide (rutile or brookite) in the material and then placing it in an energized electrostatic field of radio frequency, e.g. between 100,000 cycles per sec. and 100 megacycles per sec. Suitable thermoplastic organic materials include polyvinylacetate resins, polyvinyl esters of organic and inorganic acids, polystyrene, polyacrylates, polymethacrylates, and cellulose derivatives. Applications of this method to the heating of adhesives in cementing operations are mentioned. C.

**Cellulose Ether Compositions.** British Industrial Plastics Ltd. B.P.560,115 of 25/8/1942:21/3/1944 (Conv. 26/8/1941). Water-soluble cellulose ethers are rendered relatively insoluble when heated in the presence of an acidic catalyst by incorporating in them a soluble methylated polymethylol melamine. The compositions may be used for the production of water-resistant films and coatings for the protection and decoration of paper, textiles, etc., and with suitable fillers for the preparation of moulding compositions. C.

**Patterned Cellulose Derivative Fabrics: Production.** British Celanese Ltd. B.P.560,116 of 1/9/1942:21/3/1944 (Conv. 3/9/1941). A process for the production of a patterned fabric comprises subjecting a fabric containing cellulose derivative filaments and carrying a resist in a pattern, to the action of a solution, of not more than 50 per cent. strength, of a non-volatile plasticizer for the organic derivative of cellulose in a volatile liquid which has some softening action on the organic derivative of cellulose, and then drying the fabric at an elevated temperature. The resist is preferably a water-soluble compound such as a soluble resin obtained from polyvinyl alcohol, a gum or protein material. The parts of the fabric exposed to the action of the plasticiser acquire a semi-stiff or organdie-like finish. The pattern effects are highly resistant to laundering. A similar process may be used for the production of pattern effects on films having a basis of cellulose acetate or other organic derivative of cellulose. C.

**Cellulosic Fibres: Treatment to Improve Resistance to Wet Processing.** Courtaulds Ltd., C. C. Wilcock and W. Armfield. B.P.560,121 of 17/9/1942:21/3/1944. To increase their resistance to wet processing cellulosic fibres are impregnated with an aqueous solution prepared from dicyandiamide or guanidine, resorcinol and formaldehyde and having a pH below 7, and then heated to convert the substances into a water-insoluble product. Cellulosic materials treated in this way do not suffer any substantial loss in affinity for wool dyes when they are subjected to crabbing, setting, scouring or milling operations. C.

**Methine Dyes: Production.** A. H. Cook and Imperial Chemical Industries Ltd. B.P.560,160 of 18/9/1942:22/3/1944. Di- and tri-methine dyes are made by condensing one molecular proportion of a quaternary salt of 3-methylquinoxalone, which may optionally be substituted in the 1-position by an alkyl, aryl or aralkyl group, with one molecular proportion of a cyclic aldehyde or, in one or more stages, with one molecular proportion of an arylformamidine or an ortho-formic ester which is capable of providing a methine group, and one molecular proportion of a heterocyclic nitrogen compound containing a reactive methyl or methylene group. The products dye acetate rayon and tannin-mordanted cotton in deep red, blue and violet fast shades. C.

**Halogenated Anthraquinone Dyes: Production.** Sandoz Ltd. B.P.560,164 of 8/12/1941:23/3/1944 (Conv. 13/12/1940). Halogenated dyes are prepared by treating derivatives of 1:4-diaminoanthraquinone of given general formula, which contain halogen in the 6- or 7- or 6- and 7-positions, with halogenating agents and, if desired, sulphonating the products so obtained. The treatment of 1:4-di-(2':4'-dimethyl)-phenylamino-6-chloranthraquinone, 1:4-di-(2':4':5'-trimethyl)-phenylamino-6-chloranthraquinone, 1-amino-2-bromo-4-(2':4'-dimethyl)-phenylamino-6(7)-chloranthraquinone and similar derivatives is described in examples. The dyes obtained dye wool in blue shades of good fastness properties which remain blue in artificial light. C.

**Aeroplane Fabrics: Tautening.** J. R. Myles, F. J. Siddle, D. Whittaker and Imperial Chemical Industries Ltd. B.P. 560,168 of 8/11/1940:23/3/1944. Fabrics, particularly fabrics stretched over light structures such as aeroplane wings, are tautened by doping them with a solution of the material obtained by chlorinating solid polythenes at a temperature generally below 60° C. to a chlorine content of 60-70 per cent. by weight, and preferably also one or more substances that inhibit the liberation of free hydrogen chloride from chlorinated polythenes under the conditions of exposure to light and/or heat, and if desired, other film-forming materials and/or plasticisers. Preferably, the first coat of dope is brushed on to the fabric and subsequent coats are sprayed, brushed or otherwise applied as convenient. C.

**Dyed Cellulose Fibres: Protective Treatment against Chlorination.** Society of Chemical Industry in Basle. B.P. 560,284 of 23/12/1941:29/3/1944 (Conv. 24/12/1940 and 25/11/1941). Cotton, linen or regenerated cellulose fibres which have been dyed with dyes sensitive to chlorine can be treated in baths containing chlorine without destroying the dyes, if water-insoluble condensation products of formaldehyde and urea compounds or similarly acting compounds are produced on the dyed material prior to chlorinating in such a manner that the condensation products are present in a coherent condition in or on the fibre. This treatment is especially valuable for the treatment of cellulose fibres which are to be mixed with wool and then subjected to chlorination to prevent the wool from felting and shrinking. Another suitable application of the process is in cases where undyed cellulose fibres have to be bleached by chlorination in association with dyed fibres. C.

**Cemented Pile Fabrics: Production.** R. S. Allen (Birmingham, Michigan, U.S.A.). B.P. 560,290 of 16/7/1942:29/3/1944. In a process for the production of cemented pile fabric by the method involving pleating a fibrous web about several separator strips, cementing a base fabric to each face of the pleated structure and then splitting the resulting structure in a plane parallel to the base fabrics, a pleated structure comprising a warp and several separator strips is passed through a confining passage formed by a pair of spaced parallel plates which are provided with longitudinally extending ribs. The mechanism for depositing the strips, one by one, in the mouth of the passage includes a pleating mechanism and a strip holding magazine co-operating with a strip transfer device adapted to receive a strip from the magazine. The transfer device first receives a strip from the magazine and then, moving from its receiving to its delivery position, it deposits a strip in the mouth of the passage, the pleating mechanism then folding the warp about the strip so delivered. The pleating mechanism may include a bar having a strip-engaging surface provided with openings which communicate with a suction passage and the strip transfer device may also be provided with suction passages controlled as by a number of cam-operated valves so that the strip is held on the delivery mechanism by suction until it is engaged by the pleating bar. The suction is then cut off from the transfer device and applied to the pleating bar, means being provided for operating the pleating mechanism so as to move its bar from engagement with the transfer device to the mouth of the passage when the suction is cut off from the pleating bar. Two pleating bars may be provided and two similar strip-holding magazines may be arranged on each side of the passage mouth. As the pleated structure leaves the confining passage, cement is applied to the bights of the warp by means of rollers which travel in the same direction as the pleated structure. In addition, the structure makes contact with friction rollers rotating in the opposite direction and at a greater speed than the cement applying rollers, so that the cement is rubbed or pressed into the loops before the structure passes through a drier, with the result that the initial cohesion between the cemented pleats is employed to maintain the number of tuft loops per unit of length. C.

**Cellulose Derivative Monoazo Dyes: Production.** British Celanese Ltd. B.P. 560,298 of 25/9/1942:29/3/1944 (Conv. 1/10/1941). Monoazo dyes are obtained by coupling 1-di(8-hydroxyethyl)-amino-3-acetanilide with the diazo compound of an aminophenylsulphone or an aminophenylmethylketone in which the benzene nucleus is free from further substituents. The products dye cellulose acetate and other organic derivatives of cellulose in orange shades which

are dischargeable to white and are of very good fastness to light, acid fading and dry bleeding. C.

**Wool Fabric: Mothproofing.** W. Colman and H. L. J. Haller (to the U.S. Secretary of Agriculture and his successors in office). U.S.P.2,318,201 of 4/5/1943 (through *Chem. Abs.*, 1943, 37, 6142). Isonitrosoacetanilide is used, preferably in acetone solution and with various other compounds. W.

**Dry Carrotting Fur on the Pelt.** J. D. Sartakoff (to No-Mercury Felt Corp.). U.S.P.2,321,775 of 15/6/1943 (through *Chem. Abs.*, 1943, 37, 6909). Pelts, e.g. English rack pelts, are tumbled with a relatively large bulk of pieces of substantially acid-proof attrition material, e.g. paraffin particles, substantially free from abrasive properties and dust and carrying a substantially imperceptible coating of adsorbed highly active carrotting solution, e.g. one containing nitric acid or sulphuric acid and hydrogen peroxide, and the attrition material is then separated from the pelts. W.

**Flexible Raincoat Coating Composition.** Columbus Coated Fabrics Corporation. U.S.P.2,331,977. A flexible film-forming composition for raincoats, etc., comprises nitrocellulose, butyl acetyl ricinoleate as plasticizer, a reaction product of castor oil, maleic anhydride and glycol as "flexibilizer," diatomaceous earth as a filler, a pigment, and a solvent. C.

**Nitrogenous Cellulose Derivative Materials: Production.** Röhm & Haas Co. U.S.P.2,332,047. Cellulosic fibre, yarn or fabric is treated with a solution of a condensation product of amino-1:3:5-triazine, formaldehyde and dimethylamine, and heated at 90-140° C. C.

**Starch Product: Preparation.** Corn Products Refining Co. U.S.P.2,332,320. A suspension of starch at 95-105° F. is passed through a chlorinating tower into which chlorine gas is supplied at the rate of 0.165-0.55 per cent. on the dry starch. The chlorinated starch liquor is mixed in a tank and allowed to settle for 180-50 minutes, when an antichlor is added and the starch is filtered and dried. A small amount of Na<sub>2</sub>H phosphate is added during the cooking of such starch (containing chloro-fatty acids) to minimize thinning. The product is described as a "thermophylic free starch." C.

**Dyeing Machine.** W. E. Rowlandson (Lowell, Mass.). U.S.P.2,332,346. The machine comprises a tank through which the fabric passes in festoon form and a mixing reservoir alongside the tank which has an upper part level with the top part of the tank, connected by a narrow channel to a lower part level with the bottom part of the tank. Perforated pipes within the tank feed the top and bottom parts with dye liquor from the top and bottom parts, respectively, of the reservoir. C.

**Shoe Stiffening Fabric: Finishing.** Celastic Corporation (Wilmington, Del.). U.S.P.2,332,501. A porous fabric is impregnated with 300-900 per cent. on its weight of a polyester-polyamide formed by the interaction of a C<sub>6</sub>-C<sub>10</sub> alkyl diamine, a C<sub>4</sub>-C<sub>8</sub> alkyl dibasic acid, and ethylene or propylene glycol, the ester-forming ingredients comprising 80-100 per cent. of the composition. C.

**Retarded-exhaustion Finishing Dispersion.** E. I. Du Pont de Nemours & Co. U.S.P.2,332,817. The exhaustion of a positively-charged aqueous dispersion of a finishing agent is retarded by the addition of 0.02-0.5 per cent. of a cationic surface-active agent, based on the weight of the textile material. C.

**Rubber-cored Yarn Laminated Fabric.** J. A. Grabec (Czechoslovakia; vested in U.S. Alien Property Custodian). U.S.P.2,332,848. Elastic sheet material is formed by embedding a fabric made from rubber-cored, textile-covered yarn in rubber sheeting under heat and pressure sufficient to unite the two supplies of rubber, and then vulcanizing the assembly. C.

**Polyvinyl Chloride Plasticizing Agent.** W. Gruber and H. Machemer (Germany; vested in U.S. Alien Property Custodian). U.S.P.2,332,849. An aliphatic ester of diacetoxystearic acid is claimed as plasticizing and thermally stabilizing agent for polyvinyl chloride. C.

**Nylon Fabric Articles: Finishing.** Paramount Textile Machinery Co. U.S.P.2,333,160. Articles manufactured from synthetic linear polyamides are pre-set by treatment in the unconstrained state with an aqueous medium at a predetermined temperature, then given a hot liquid treatment at the same or a

lower temperature, and finally re-set on a form by the action of an aqueous medium at a higher temperature. C.

**Cellulosic Fibres: Enhancing Dye Affinity.** General Aniline and Film Corporation. U.S.P.2,333,203. Cellulosic material is heated with pyridine or quinoline (if desired, in an indifferent diluent) and a compound of the formula  $R \cdot O \cdot CHY \cdot Hal$ , where R is a radical with up to 6 C atoms, or benzyl, and Y is H or methyl. C.

**Azo-dyed Cellulose Derivative Fabric: Discharge Printing.** Celanese Corporation of America. U.S.P.2,333,204. The material is printed with a discharging composition, aged, and washed at 10-35° C. in an alkali hydroxide or carbonate solution that is not sufficiently concentrated to injure the material. C.

**Singeing Machine Burner.** M. R. Kelly and J. T. Melton. U.S.P.2,333,381. The burner consists of a gas pipe with a slot along one side and a compartment, spaced from the pipe and encircling all but the slot region, through which a cooling liquid is conducted. C.

**Fabric Printing Drum.** C. P. Kent (Lyndhurst, N.J.). U.S.P.2,333,382. A perforated, rotatable drum houses a series of paint or lacquer containers that can be fed with pigment under pressure. Each container has a top opening, normally closed by a plug, through which the pigment enters and a bottom opening that is regulated by a segment-shaped plate and is kept clear by an oblique doctor blade. C.

**Arylaminoanthraquinone Dye for Cellulose Acetate.** E. I. Du Pont de Nemours & Co. U.S.P.2,333,384. Compounds of the formula  $RO \cdot C_6H_4 \cdot NH \cdot C_{14}H_9O_2 \cdot OH$ , in which R is  $-CH_2 \cdot CO_2H$ ,  $-CH_2 \cdot CH_2 \cdot OH$ ,  $-CH_2 \cdot CO_2Me$  or  $-CH_2 \cdot CO_2Et$ , and the NH and OH groups are attached to the anthraquinone system at positions 1 and 4, are claimed as violet dyes, fast to gas fumes, for cellulose acetate. C.

**Finishing Agent.** Montclair Research Corporation. U.S.P.2,333,623. The reaction product of formaldehyde, a nitrile ( $<9$  C), an acid chloride ( $>9$  C) and a tertiary amine is claimed. [The full specification says that agents of this type impart a soft, suede handle and that the impregnated cloth becomes water-repellent if baked at 140-170° C.]. C.

**Textile Material: Recovery from Rubber Goods.** R. E. Tefft (to Allied Chem. & Dye Corp.). Canadian P.407,228 of 8/9/1942 (through *Chem. Abs.*, 1942, 36, 6816). The material is digested at 120-160° with sulphur, a vulcanizing accelerator, and rubber solvent, e.g. anhydrous aromatic hydrocarbons, and the textile material then separated from the solution. W.

**Waterproofing Fabrics which Retain Air Permeability.** Textilwerk Horn A.-G. D.R.P.725,120 of 30/7/1942 (through *Chem. Abs.*, 1943, 37, 5874). The fabric is impregnated first with a paraffin solution, then with a dilute solution of a synthetic resin, e.g. polyvinyl acetate in benzene, and finally with a water-repelling solution, e.g. paraffin solution (for the second time). The fabric is then calendered at approx. 25°. W.

**Felt and Straw Hats: Stiffening.** I.G. Farbenind. A.-G. D.R.P.725,794 of 13/8/1942 (through *Chem. Abs.*, 1943, 37, 6142). Hats are treated with mixed- or hetero-polymers of at least one polymerizable olefinic compound having no free carboxyl groups and at least one olefinic monocarboxylic acid. Salts of such polymers can also be used. The hats are then treated with a salt solution which renders the polymer insoluble. W.

**Animal Fibres: Bleaching with Hydrogen Peroxide.** R. Sarg (to Elchemie G.m.b.H.). D.R.P.727,153 of 24/9/1942 (through *Chem. Abs.*, 1943, 37, 6470). Fibres, e.g. hair or bristles, are treated with reducing sulphur compounds and solutions of iron salts either simultaneously or consecutively. The bleaching is then finished as usual. W.

**Textiles: Milling.** J. Breuer (to L. Ph. Hemmer, G.m.b.H.). D.R.P.727,568 of 8/10/1942 (through *Chem. Abs.*, 1943, 37, 6908). The heat required for milling is supplied by an alternating current passed through the fabric. W.



## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Balls Sledge Cotton Sorter: Description and Application.** R. W. Vose. *A.S.T.M. Standards on Textile Materials*, 1943, 415-419. A brief description is given of the draw box and carriage of the Balls sledge sorter and their manipulation and use for plotting fibre length distributions. The accuracy of the instrument was checked by direct measurement of length on 25 fibres taken at each of a number of places on the plush spread. Except for one or two points the distribution of length of the 25 fibres was within the chosen limits and the averages for the 10, 15, 20, 25, 30 and 35 m.m. groups were, respectively, 9.7, 14.9, 19.4, 24.5, 29.2, and 33.0 m.m. This calibration is better than some reported by Balls; the improvement is ascribed to a superior quality of plush and to small mechanical modifications in the instrument. As typical of the use of the sorter, a set of frequency curves is given for a sample of cotton in the bale (12 bales) and in the scutcher lap, draw-frame sliver, card sliver, card strips and roving. C.

**Fibre Projection Apparatus: Application.** J. H. Graff and J. R. Feavel. *Paper Trade J.*, 1944, 118, *TAPPI*, 53-57. A projection arrangement for use in measurements of fibre dimensions consists of a projection microscope from which the microscope tube has been removed; in place of an objective, the microscope is equipped with an F 12.5 mm. f 2.8 projection lens. The microscope and illuminant are placed in a box-like table equipped with a reflecting mirror. The inside of the box is painted a dull black. On the top of the table-box and above the reflecting mirror is a ground glass (finely ground) on which a series of lines are drawn at 7.5 mm. intervals, representing an actual space between the lines of 0.1 mm. at 75 diameters magnification. Above the ground glass is a hood (the interior of which is painted dull black), which makes it possible to observe and read the dimensions of the projected fibres without disturbance from the light in the laboratory room. For measurements on pulp fibres, the fibres are stained with Bright stain and the pulp diluted so that 1 drop (using a dropper with 5-mm. inside opening) will contain about 25 fibres. One drop of the suspension is placed on each of eight slides. The slides are dried and the fibres are then treated with a drop of standard calcium chloride solution, straightened out with a dissecting needle and arranged side by side parallel to the length of the slide. The slide is then put on the stage of the projection microscope and fibre lengths are determined to the nearest 0.1 mm. and fibre widths to the nearest 0.01 mm. At a magnification of 75 diameters ray cells, fibre fragments and broken and whole fibres can be distinguished. A minimum of 200 measurements should be made. The arithmetic and weighted average fibre lengths, the average width, the length/width ratios, and the average area of the fibres, and also the percentage frequencies of the length and area can be calculated from the measurements. Results obtained for various pulps are tabulated and the advantages of comparing different pulps, as regards their relative percentages by weight of short, medium long, and long fibres, by plotting these values on a triangular chart are demonstrated. The influence of the size of the mouth opening of the dropper and the probable errors in average lengths and widths based on measurements of 100 to 1000 fibres are discussed. C.

**Cellulose-Water Adsorption Isotherm: Interpretation.** A. G. Assaf, R. H. Haas and C. B. Purves. *J. Amer. Chem. Soc.*, 1944, 66, 66-73. Three highly-swollen cellulose samples of cotton linters were studied by the thallous ethylate method. Extrapolation of the linear plots of methylation against molecular volume to volumes of 18 and 35 gave the respective percentages of cellulose theoretically accessible to water vapour and nitrogen gas. The moisture adsorption isotherms, at 20° or 25°, of the same swollen samples were determined. The moisture content at the second region of inflection in the sigmoid plots, occurring at R.H. about 50 per cent., was approximately that predicted from the results above by assuming the adsorption of one water molecule by each accessible alcoholic group. This region in the isotherm was considered to be approximately equivalent to a unimolecular water layer completely covering the accessible surface of the cellulose. The moisture content at the first region of inflection in the isotherm, occurring at R.H. about 10 per cent., was approximately one-third of the value at the second inflection. This fact, together with



other considerations cited, suggested that the avid adsorption of water up to the first inflection was mainly a function of the strong hydrogen-bonding capacity of the accessible, primary alcoholic groups. The intermediate portion of the isotherm represented the water less strongly hydrogen-bonded to the secondary alcoholic groups, but its shape was influenced at the higher humidities by the effects of swelling and by capillary condensation. Some physical-chemical implications of these ideas are discussed, particularly the inference that the moisture sorption characteristics of cellulose and starch at 80° or more must be those of the primary alcoholic groups exclusively. Up to 98 per cent. of the surface of moist, swollen cellulose was obliterated by direct drying, but up to 75 per cent. was preserved during solvent-exchange with ethanol. The adsorption of 6 per cent. to 9 per cent. of water increased the colloidal surface of highly swollen cellulose by at least 20 per cent., but the increase for unswollen samples was perhaps thirtyfold. These data throw fresh light upon the significance of the mercerisation or reactivity ratio of cellulose, which is usually given as about 1.5. The surfaces of two of the swollen cellulose samples were estimated by the standard method involving the determination of the nitrogen adsorption isotherm at  $-195.8^{\circ}$  but the correlation of this method with the thallous ethylate technique requires further study. C.

**Cupri-ethylenediamine Cellulose Solutions: Viscosity; Rapid Determination.**

R. M. Levy, P. Muffat and W. D. Harrison. *Paper Trade J.*, 1944, 118, TAPPI, 45-47. Details are given of a rapid method for the determination of the viscosity of cellulose in cupri-ethylenediamine solutions which is suitable for control purposes in pulp and paper mills. Moist pulp samples can be used without previous drying. The pulp is first subjected to a wet disintegration and then measured into a dissolving tube and mixed with an equal volume of double-strength cupri-ethylenediamine solution (1.0M. in copper). The pulp is stirred for 5 min. and the viscosity determined with a capillary viscometer. An aliquot part of the pulp suspension is also filtered on a Buchner funnel, dried on a steam cylinder, and finally weighed in a conventional type of heated pulp balance. The viscosity is then corrected to a standard weight from a set of simple tables. The entire test, including all operations in duplicate, can be carried out by unskilled workers in approximately 20 min., and results obtained which are reproducible within 1 per cent. or better. C.

**Fibres: Specification and Testing.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 457 pages. The following standard has been revised in 1943: D276, Tentative methods for identification of fibres in textiles (pp. 18-36). C.

**Rayon Staple: Commercial Weight Testing.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 257-259. "Tentative Method of Test for Commercial Weight of Rayon Staple," D540, lays down the conditions for sampling from the bale, preparing test specimens (about 300 gm.), "boiling off," and determining the moisture regain. C.

**Casein Bristles: Production and Properties.** T. L. McMeekin. *A.S.T.M. Bull.*, 1943, No. 125, 19-21. A general account is given of the production, properties and uses of casein bristles. Data showing the water absorption of untreated and formaldehyde-hardened fibres, lysine content, and flexibility of fibres prepared from various proteins are presented. Hardening agents for casein fibres are briefly discussed. C.

**Clam Muscle Fibrils: Electron Microscope Observations.** M. A. Jakus, C. E. Hall and F. O. Schmitt. *J. Amer. Chem. Soc.*, 1944, 66, 313-314. Electron micrographs show the fibrils obtained from the adductor muscles of marine and fresh-water clams to be very long and evenly contoured, with widths usually between 200 and 1000 Å. In fibrils treated with osmic acid the density along the axis is not uniform but shows a periodic variation producing a cross-striated appearance. From measurements of 100 fibrils a distribution curve of "spacings" of this fibre axis repeat pattern was constructed. All the values lay between 290 and 470 Å. The most frequently occurring spacings were between 330 and 390 Å., the average value of all spacings being 360 Å. X-Ray diffraction data indicate that the fibre axis period in the intact dried muscle is 720 Å. It is suggested that the larger X-ray period reflects density differences

not yet resolved with the electron microscope but which may become apparent when special methods are applied. C.

**Shirley Analyser: Application.** G. W. Pfeifferberger. *Textile Research*, 1944, 14, 50-54. The Shirley Analyser is briefly described. It is pointed out that there is a good correlation between Shirley Analyser waste percentages and combined scutcher and card waste so that rapid determinations can be made of the waste loss that may be expected in the mill. The relation between waste and grade is discussed and it is shown that an examination of waste may serve to explain some apparent discrepancies. "Grade" entails three factors—colour, leaf, and preparation. If two samples of cleaned lint are difficult to distinguish from each other, the difference in grade designation can be attributed to factors other than colour. If the cleaned samples differ in appearance, fibre deterioration as reflected by colour is indicated. Another useful application of the Shirley Analyser is for the analysis of mill waste products. A table is given showing percentages of clean lint recovered from samples of raw stock, finisher laps, finisher motes, card motes, flat strips, and cylinder and doffer strips. Average values are 97, 98, 45, 56, 89 and 96 per cent., respectively, indicating that a large part of the material now considered as waste is composed of good, usable fibre. This statement is substantiated by the results of fibrograph length tests on the reclaimed fibre. Fibrograph or array measurements used in conjunction with the Shirley Analyser would be useful for determining proper settings on scutchers, cards, combers, etc. The possibility of using the principle of the Shirley Analyser in the commercial cleaning of cotton either at the gin or in mill opening processes is discussed. C.

**Polyamide Fibres: Fine Structure.** K. Hess and H. Kiessig. *Naturwissenschaften*, 1943, 31, 171 (through *Chem. Abstr.*, 1944, 38, 181<sup>9</sup>). The condensation product of hexamethylenediamine and adipic acid or that of  $\epsilon$ -aminocaproic acid gives new reflexes in the meridian of the X-ray pattern (diatropic interferences) of period 74 Å., for poly- $\omega$ -hydroxydecanoic acid 79 Å., and for poly- $\omega$ -hydroxyundecanoic acid 65.5 Å. The reflexes are weaker for the latter two. The periods have no relation to the usual fibre period. Heating of the fibre increases the period length irreversibly. The exact origin is not given. C.

**Textile Fibres: Elastic Properties.** H. J. Henk. *Spinner u. Weber*, 1942, 60, No. 19, 14-15 (through *Chem. Zentr.*, 1943, i, 799 and *Chem. Abstr.*, 1944, 38, 872<sup>3</sup>). The elasticity of textile fibres is compared with that of rubber and is related to structure. Silk and cotton exhibit only slight true elasticity because of the stretched condition of their principal valence chains. Wool is highly elastic, owing to the possibilities of transformation of the  $\alpha$ - and  $\beta$ -keratin during the stretching. The behaviour of the polypeptide chains during stretching, reversible and irreversible stretching, the significance of the amino groups in irreversible stretching, and the effect of pH on the extent of the stretching are discussed. C.

**Wool Scale Cells: Electron-microscope Pictures.** H. Zahn. *Textilberichte*, 1943, 24, 137-160 (through *Chem. Abstr.*, 1944, 38, 646<sup>9</sup>). In the degradation of isolated scale cells with pancreatin, fibrils are set free which agree in their structure with those found in the spindle-shaped cells. The structures are very long, are arranged parallel and are 100-500 m $\mu$  wide. C.

**Wool: Testing Resistance to Bacteria.** B. Schulze and H. Sommer. *Textilber.*, 1943, 24, 105-108 (through *Chem. Abs.*, 1943, 37, 6465). Differently treated wool fabrics were subjected to the action of bacteria and of Burgess's trypsin solution, respectively. The wool damage was determined microscopically and titrimetrically. The microscopic method is more accurate and more sensitive. The attack by bacteria takes place more slowly than that by trypsin solution. Neither method can be substituted completely for the other. The use of *B. subtilis* alone or with wool-damaging bacteria made no difference in the results. Samples treated with Eulan N and chrome were fairly resistant to bacteria, but nearly all were attacked by trypsin solution. W.

(B)—YARNS

**Cordage: Testing.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 121-128. "Tentative Methods of Testing and Tolerances for Spun, Twisted, or Braided Products made from

Flax, Hemp, Ramie or Mixtures thereof," D739, lays down definitions, tolerances, and methods of sampling and determination of weight per unit length, breaking load, twist, diameter, alkali solubility, sizing and finishing material, regain, matter soluble in ethylene dichloride, and analytical values of the constituent waxes. C.

**Rope: Testing.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 117-120. "Tentative Methods of Testing and Tolerances for Rope (Leaf and Bast Fibres)," D738, lays down conditions for sampling and conditioning, and determination of weight per foot, circumference, length per turn, breaking load (dry and wet), extractable matter (solvent), and fungicides. C.

**Vinyon Yarn: Properties.** Carbide and Carbon Chemicals Corporation. *Silk and Rayon*, 1944, 18, 261. Vinyon yarn is spun from an acetone solution of a co-polymer of vinyl chloride (90) and vinyl acetate (10). The average molecular weight, according to the Staudinger viscosity rule, is 20,000. The freshly spun yarn is weak, but it is stretched by several hundred per cent. while hot and "set" under tension at 90-100° C. The filaments then have breaking loads of more than 4 gm. per den. They retain their dimensions at temperatures up to 65° C., but shrink at higher temperatures and become tacky at 135-140° C. Very fine filaments are spun, e.g. 10 fil. 8 den. yarns. The specific gravity is 1.34-1.36. Vinyon does not absorb moisture and is water-repellent, though it can be wetted if a wetting agent is used. It is resistant to acids, alkalis, salt solutions, cuprammonium, and organic solvents other than ketones, esters, amines and halogenated hydrocarbons. It is a non-conductor of electricity, is non-inflammable, and immune to mildew and bacteria. It has been used for filter cloths, for anode bags in electrolytic operations and for clothing in chemical work. C.

**Yarns: Designation of Construction and Twist.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 337-339. Examples are given of extensions of the S and Z system of designating yarn twist to include, in order, the direction of twist, the amount of twist and the type of fibre, the shilling stroke being used to indicate a folding operation. Thus, 100-60 Z 60 Viscose & 100-40 S 3 Acetate/2 S 12 designates a ply yarn made by twisting together one end of 100-den. 60-fil. viscose yarn having 60 t.p.i. of Z twist and one end of 100-den. 40-fil. acetate yarn having 3 t.p.i. of S twist, the ply yarn having 12 t.p.i. of S twist. C.

**Yarns: Specification and Testing.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 457 pages. The following standard has been revised in 1943: D508, Standard methods of testing and tolerances for yarns spun from mixed fibres. (pp. 47-51.) C.

**Yarn Calculation Tables.** Ernest Whitworth. *Textile World*, 1944, 94, No. 1, 64-65. The following "ready reckoners" are provided: (1) Table of yards per pound of various yarns in counts 1 to 9. (2) Conversion factors for seven count systems. (3) Table of equivalent counts of yarn in the same seven systems. C.

**Grex Universal Count System: Application.** A. G. Scroggie. *Textile Research*, 1944, 14, 36-39. Problems that would be met with in the adoption of the Grex count system are briefly discussed and suggestions are made for the conversion of testing instruments. Applications of the system to single and plied yarns are considered, its effects on yarn twist and fabric cost and conversion calculations and in the control of yarn manufacture and strength tests are indicated, and its advantages are pointed out. Extracts are given of letters from members of the American textile industry endorsing the system. C.

**Rayon Yarns: Use for Insulation of Fine Wires.** A. Brookes. *Engineering*, 1944, 157, 263-264, 281-283. Properties required in insulating materials for fine wires, particularly those for use in electrical equipment which may be exposed to tropical conditions, are discussed. Possible substitutes for silk are reviewed. Where space factor is of secondary importance, silk may in many cases be replaced by fine cotton, acetylated cotton (Cotopa), varnish-impregnated lapped paper or pulped paper. Glass fibre yarn is suitable for heavier gauges. Cellulose acetate rayon has been used in large quantities on large-gauge wires, switch-board cables, cords, etc., and proved superior even to silk for such coverings. A

light fusion of the surface of the covering after lapping by suitable heat treatment provides a covering of high abrasion resistance. "Fortisan" (regenerated cellulose) has great resistance to abrasion and excellent covering power. Durafil is also useful. Nylon is produced in filaments fine enough for wire covering, but is more expensive than the other types mentioned. Notes are given on the methods of production and properties of these various artificial filaments, yarn count systems are explained, and the results of tests of the different types of wire coverings are discussed. Average values of electric strength for silk coverings vary between 350 and 720 volts per mil, the most frequent value being of the order of 670 volts per mil. Fused cellulose acetate, single lapped, gives 730 volts per mil, as a median value, with 620 and 800 volts per mil as normal extremes. Nylon gives an average figure of 550 volts per mil. Figures for cuprammonium rayon and Fortisan coverings vary considerably with the humidity. Average breakdown temperatures of coverings are: cotton, 376° C.; Fortisan, 375° C.; cuprammonium and viscose rayons 365° C.; silk, 355° C.; nylon, 254° C.; and cellulose acetate, 220° C. In comparative abrasion tests, the highest resistance figures were obtained with a double-lapped cellulose acetate fused. Rayons do not permit minimum wire elongations of 20-30 per cent. as obtained with silk, but 15-17 per cent. is commonly attained with cellulose acetate. In general it can be said that where a textile covering is essential and the electrical properties and space factor demand a high standard, cellulose acetate, fused after lapping, and nylon are the most suitable substitutes for silk. Where electrical properties and moisture resistance are not so important, or if varnish impregnation is used, Fortisan may be used on good elongation wire and if, in addition, space factor is not important, the range may be expanded to include cuprammonium or viscose rayon strong yarns. C.

#### (C)—FABRICS

**Circular Knit Underwear Fabrics: Defects.** *Textile World*, 1944, 94, No. 1, 86. Illustrations are given of (1) loose stitch, (2) cut hole, (3) pulled stitch, and (4) needle mark defects in underwear fabrics, and causes and remedies are suggested. C.

**Fabrics: Air Permeability Test.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 61-62. "Tentative Method of Test for Air Permeability of Textile Fabrics," D737, lays down the conditions under which conditioned air is drawn through a known area of fabric, after establishing a known pressure gradient across the fabric (usually half an inch of water), and the volume of air is measured in some suitable way. The "air permeability" is expressed in cubic feet of air per minute per square foot of fabric at the stated pressure gradient. Tests are made at  $70 \pm 2^\circ$  F. and  $65 \pm 2$  per cent. R.H. C.

**Glass Fibre Fabrics: Testing.** Committee D13, American Society for Testing Materials. *A.S.T.M. Standards on Textile Materials*, 1943, 226-233. Particulars are given of the following new "Standard Methods of Testing and Tolerances" for Woven Glass Fabrics (D579), Woven Glass Tubular Sleeveing and Braids (D581) and Woven Glass Tapes (D580). C.

**Quality Control Charts: Applications in Cloth Production.** O. P. Beckwith. *Textile World*, 1944, 94, No. 1, 79-81, 134-140. An explanation of "quality control" by means of charts marked with upper and lower permissible limits of a test value. The importance of the correct selection of these limits is emphasized by some charts for the finished weight of a fabric. The advantages of "quality control" are enumerated. C.

**Wire Mesh Screens: Hydraulic Properties.** J. F. Halladay. *Paper Trade J.*, 1944, 118, TAPPI, 48-52. In a study of the flow of water through woven wire mesh screens of the type used in the paper industry use was made of a device comprising a Lucite tube 3.75 in. in diameter and about 40 in. long with a thin metal plate at one end having a circular aperture over which the cloth to be tested was fixed. Measurements were made of the time ( $t$ ) for a head of water in the tube to fall from an initial value  $H$  (in feet) to a value  $h$ . Tests were made with starting heads of 30 and 20 in., orifice diameters of 0.6875 and 0.91 in., and wire mesh screens of 40, 80, and 100 meshes per in. at water temperatures ranging from 44° to 122° F. It was found that the ordinary hydraulic laws governing discharge through orifices could be applied and  $t$  was given by

the relation  $t = 2A(\sqrt{H} - \sqrt{h})/ak\sqrt{2g}$ , where  $A$  = area of horizontal cross-section of vessel in sq. in.,  $a$  = area of discharge orifice in sq. in.,  $g$  = acceleration due to gravity, and  $k$  = discharge coefficient of orifice. A direct and practically linear relation was observed between the hydraulic discharge coefficient and the calculated open area of the wire cloth. Increase of about 80° F. in water temperature caused increases of not more than 10 per cent. in discharge coefficients.

C.

**Quality Control Charts: Textile Applications.** A. G. Ashcroft. *Text. World*, 1943, 93, No. 12, 69-71. Statistical control does not by itself make quality or uniformity, but assists in judging the significance of variations in the quality record. The technique is based on statistical theory, details of the sources of which are given, but the actual operation involves only simple mathematics. Charts, as used by Alexander Smith & Sons Carpet Co., U.S.A., are illustrated for controlling the weight, strength and yarns per in. of Army blanket and duck, and for recording the porosity or leakage values of duck.

W.

**Friction Meter for Determining the Coefficient of Kinetic Friction of Fabrics.** E. C. Dreby. *J. Res. Natl. Bur. Standards*, 1943, 31, 237-246. A friction meter, designed at the instigation of the American Society for Testing Materials and the National Bureau of Standards, with the object of developing methods for the evaluation of textile finishes, is described. One piece of cloth is drawn over a second piece, whilst the two are pressed together by a standard load. One end of this second piece is fixed to a clamp on a torsion element and the frictional force measured by the deflection of this element, recorded by a dial gauge. The factors which affect this dial reading, e.g. relative speed of the two patterns, load applied to the contact surfaces, repeated testing of the same two pieces, etc., are enumerated and their various effects described. These investigations lead to the formulation of a standard testing technique. Various applications to the evaluation of smoothness are given. An investigation on the coefficient of friction of 18 samples which had been graded for smoothness by a number of experts, showed (by the application of the Kendall method of rank correlation) that factors other than the coefficient of friction enter into an expert's judgment of handle. The combined use of 3 measurable characteristics of cloth, friction, flexibility and compressibility is given as an example of how it may be possible to evaluate handle by physical tests. Examples are given of the use of the friction meter for determining the effect of finishing treatments, e.g. finishing agents, calendaring, and laundering on the frictional properties of fabrics, as well as the properties of fabrics composed of different fibres and yarn and cloth construction.

W.

#### (D)—OTHER MATERIALS

**Gas Permeability Measuring Apparatus.** A. C. Shuman. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 58-60. Apparatus for measuring the gas permeability of film materials of low permeability is described and details of its construction are shown in a diagram. The method involves measuring with a manometer changes in pressure inside a small evacuated space due to gas passing through the test specimen. Results are recorded as c.c. of gas at standard conditions of temperature and pressure transmitted per 100 sq. in. of surface per 24 hours. The calculations are explained and results obtained with samples of laminated glassine and polyvinyl alcohol coatings are discussed. The apparatus can be used for measuring the gas permeability of film materials having permeabilities as low as 0.001 c.c. per 100 sq. in. per 24 hours.

C.

**China Clay: Electron Microscopy.** W. Eitel. *Ber. deut. keram. Ges.*, 1943, 24, 27-53 (through *Chem. Abstr.*, 1944, 38, 461<sup>9</sup>). Photographs were made by utilizing the differences of penetrability of particles by electrons. Kaolin is characterised by individual crystals having hexagonal outlines. Montmorillonite has a strong tendency to form finely flaked, leafy aggregates, which appear as a cloud in the electron microscope. The absorption of electrons is increased by exchanging the lighter cations of the montmorillonite for heavier ones. Halloysite has crystals shaped like a shoe last. Layer-forming tablets are shown by mica and its decomposition products, as well as talc and soapstone. The electron diffraction diagrams of the above clay minerals correspond with the X-ray diagrams. A tabular summary of the electron-microscopic interference fringes and spots furnishes the basis for the quantitative analysis of clays. A

potential of 70 kv. was used as a standard in preparing the summary. The electron-microscope picture of soapstone heated to 700° resembles that of unignited talc. Soapstone crystals heated to 800° become turbid and flake off. The interference diagram shows that at this temperature the talc crystals have completely disappeared and have been replaced by protoenstatite. Formation of the free oxides was not observed with talc. Recrystallisation of the protoenstatite begins at 900°. Soapstone heated to 900-1200° contains protoenstatite and cristobalite. Above 1200° protoenstatite passes irreversibly into stable clinoenstatite. The behaviour of talc on heating is similar to that of soapstone. Kaolin heated to 500° shows no change in electron-microscope picture or diffraction diagram. At 550-600° dehydration sets in and diffuse scattering halos appear in the diffraction diagram. Up to 800° these halos remain unchanged in position and sharpness, but increase in intensity with increasing temperature. These lines do not belong to mica, muscovite, or biotite. At 900° all of the kaolin lines have disappeared and the first lines of the mullite diagram are seen. Above 1100° these lines predominate. Finally typical lines of cristobalite appear. C.

## 7—LAUNDERING AND DRY-CLEANING

### (A)—CLEANING

**Detergents: Efficiency.** J. C. Harris. *A.S.T.M. Bull.*, 1943, No. 125, 27-33. A report is given of studies of the efficiency of Santomerse products, with and without various additions, in hard water and sea water. Washing tests were carried out by the "multiple suds" method on Indian Head fabric soiled with a standard soil, and the degree of soil removal was measured by means of the Lange photo-electric photometer. In general increasing water hardness reduced detergative efficiency. A 0.8 per cent. concentration of Santomerse No. 1, and a 0.32 per cent. concentration of Santomerse No. 3 produced optimum results in extremely hard water. These percentage concentrations are of equivalent active ingredient content. Absence of sodium sulphate in the Santomerse No. 3 product results in increased detergency. Santomerse combined with trisodium phosphate, tetrasodium pyrophosphate, or a mixture of the latter with sodium acid pyrophosphate gave results superior to those obtained with Santomerse alone. Santomerse Nos. 1, 3, and 55 were found to be poor sea water detergents. Addition of soap increased detergent action. For optimum detergent results with 51-D-7 bar (tallow kettle soap + Santomerse No. 55) the pH should be as near to 10 as possible, and the concentration 2 per cent. Additions of tetrasodium pyrophosphate or sodium carbonate to Santomerse increased the detergent efficiency of Santomerse in sea water. A ternary combination of Santomerse, soap and tetrasodium pyrophosphate produced unusually low soil removal. C.

### PATENTS

**Improvements in or Relating to Laundry Washing Machines.** Baker Perkins Ltd., F. Dewhurst and J. E. Pointon. B.P.558,456. App. 23/12/41. Acc. 6/1/44. It is stated that rotary washing machines either of the normal or end loading type suffer from constructional defects, including lack of rigidity, liability to leakage at the joints and bearings, undue wear and considerable maintenance costs. The new design aims at reducing these defects to a minimum and at the same time producing a neat machine in which excrescences such as pipes, pipe mountings, brackets and the like, are eliminated or reduced to a minimum. The use of an external trunnion drive and the penetration of the casing and end portions or heads by trunnions is avoided. The outer casing is in two parts which are connected by vertical flanges at the centre of the machine or other position, or by horizontal flanges. Each part consists of a head or end portion, having a hollow supporting base which can be bolted to the floor and a horizontal cylindrical or barrel portion. A dip gauge is provided by fitting a glass window to part of the casing at one end. The bearings are contained in the two head portions of the machine and the main driving pinion is integral with one end of the cage so that the driving mechanism or part of it actually rotates in the wash liquor. The drive is by an individual motor through reduction gearing housed in a suitable casing. Conduits are disposed within the casing so that water is supplied simultaneously through both hollow trunnions of the cage. A charging hopper is fitted for introducing the washing solutions,

and it is connected to a longitudinal conduit in the barrel portion. Steam is admitted through steam inlets in the bottom of the casing. La.

**Phosphatic Water Glass Detergents: Preparation.** Diamond Alkali Co. U.S.P. 2,333,443/4. (1) Alkali metasilicate with 2.9 mols. of water of hydration is melted and mixed with dry alkali pyrophosphate. The composition, containing 5-40 per cent. of the pyrophosphate, is cooled and ground to a dry powder. (2) A similar product contains 25-40 per cent. of Na tripolyphosphate. C.

## 8—BUILDING AND ENGINEERING

### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Cotton Fabrics: Use in Laminated Plastics.** *Textile Research*, 1944, 14, No. 1, 11-14. A discussion of the use of cotton fabrics in the production of laminated plastics, the advantages and disadvantages of cotton fabrics compared with other materials, such as paper and fibreglass fabrics, for this purpose, and the need for the development of new fabric constructions especially suited to specific needs and for investigations of factors governing fabric strength and their relationship with the strength obtained from a fabric when used as a filler in a laminated plastic. C.

**Ground Plastic Spools: Production.** P. G. Weiller. *Machinist*, 1944, 88, No. 1, 97-98. A method for the production of Bakelite spools by wet grinding is described. Laminated Bakelite is received in the form of round bars  $1\frac{1}{2}$  in. in diameter which are first ground to final diameter in a conventional centreless grinder. A 0.001 in. tolerance is easily kept. The bars are cut into short lengths, sufficient for five spools, and fed to a specially designed grinder. A steady stream of water flows through the machine and keeps the wheels and work covered during the grinding. As the work emerges there is no change in the outside diameter. Sloping heads of the spools are kept within 0.0005 in. tolerances. The grinding wheels also form a 0.015 in. high shoulder on the inside of each of the spools. The machine is fully automatic and produces approximately 30 bars of 5 spools per hour. Spool blanks come from the grinder joined by a quill, which is then broken, as from this point on the blanks are handled individually. Blanks are placed in a special collet on the turret lathe, where the centre hole is drilled and the wheel head hollowed out. For the final operation, the spools are placed in two fixtures, one for grinding slots across the head and another for grinding slots parallel to the spool's axis. The spools are always covered by water except during the lathe operation. Dimensions remain stable in storage. The spool increases in diameter about 0.001 in. during the entire operation. As this increase remains stable machine settings are adjusted to compensate. C.

**Plastics: Use in Post-war Building.** H. H. Lusty. *British Plastics*, 1944, 16, 55-60, 116-118. Thermo-plastic and thermo-setting plastics and their physical characteristics are briefly described and the manufacture and uses of moulded plastics and sheet plastics are discussed. Possible developments in the use of plastics for windows and frames, wall and floor tiles, plumbing systems, and interior decoration are outlined. The development of synthetic resin-bonded plywood and its use in the manufacture of prefabricated houses are discussed. C.

**Reinforced Laminates and Plastics Heater Panels.** Reinforced Plastics Ltd. *British Plastics*, 1944, 16, 97-102. Armoured reinforcing material comprising a fabric having cotton and 24 high-tensile steel wires to the inch in both warp and weft is being used as a core in laminated paper and fabric materials to which it imparts high strength, high resistance to impact and shattering, and dimensional stability. This reinforcing material has also been applied to resin-bonded plywood and moulded plywood construction, to give increased strength and dimensional stability. Possible post-war applications of such reinforced materials, e.g. in the construction of railway rolling stock, are briefly discussed. For the construction of "Yarworth" electric panel heaters resistance wire is woven into fabric and fro in the form of loops, the ends being eyeleted to give good terminal connections. The whole is then impregnated with phenol-formaldehyde resin and pressed between a laminated paper material, resulting in a flat flexible sheet about  $\frac{1}{8}$  in. thick and weighing approximately 3 oz. per sq. foot, possessing a hard, glossy surface. The panels may be used as bed warmers and for other domestic and similar purposes. Panels can be fitted into



ceilings, walls, etc. Similar panels can be used as electric heating mats for cars, buses and rail coaches. They are non-inflammable, waterproof and non-corrodible. C.

**Wood: Glueing.** W. Gallay and G. G. Graham. *British Plastics*, 1944, 16, 50-54, 103-112; *Modern Plastics*, 1944, 21, No. 6, 126-129, 168-172. Laminated wood and plywood, and adhesives used in their production are discussed. Present glueing procedures are reviewed and the application of high frequency heating is considered. Details are given of a new glueing process in which a synthetic resin adhesive is used in conjunction with acetylene black or other highly conductive black so that the glue line is rendered conductive. Electrodes are placed at the edges of the glue line and a low voltage current of ordinary characteristics, e.g. direct current or 60 cycle A.C., is passed through the glue line. Rapid heating is obtained directly in the adhesive, and the latter is thus conveniently and efficiently hardened. The preparation and application of glue-black dispersions, the use of a carrier such as mesh fabric for the black or for the black and resin glue, the use of unsupported resin-black films, types of resin glues used, current characteristics, the proportion of conductive black, the dimensions of assemblies, time of glueing, electrodes, pressure, temperature and moisture content of wood, equipment, power requirements and efficiency and the quality of the glue line are discussed. Promising results in large scale trials are reported, various applications are discussed, and the advantages of the new glueing process are pointed out. C.

**Ethylcellulose Plastic: Extrusion.** *Modern Plastics*, 1944, 21, 132-134, 180. Ethylcellulose is one of the easiest plastics to extrude. Type ER is used for most applications, whilst type ELT is of exceptional value where extremely low temperatures are encountered. Type ELT also has somewhat better heat resistance than the ER type of material. Extruded tubing, strips and complicated shapes are very durable owing to the inherent mechanical strength and toughness of the plastic. Extruded products normally have a smooth, glossy surface, but it is possible to get matte finishes and retain good mechanical properties. Ethylcellulose plastic should be dried prior to extrusion since the absorption of even a small amount of moisture in storage or in transit is apt to result in a poor extruded section. Drying in a hot-air or infra-red oven at 80 to 90° C. for one hour immediately before extruding is ample for all grades. The temperature of the plastic mass as it comes from the die should be in the range 340-400° F. It is suggested that the plastic extrusion machine should have at least three, and preferably four, individually controlled temperature zones. The extruded plastic may be taken from the machine either by conveyor or by draw rolls. In the extrusion of ethylcellulose tubing, air is required to inflate the tubing during the cooling period. Ethylcellulose can be extruded to very close tolerances, the variation being of the order of  $\pm 1$  per cent. Dies should be 10 to 25 per cent. larger than the plastic section to be extruded and the piece drawn to the proper size by suitable adjustment of the speeds of the extruder and take-off mechanism. A list is given of some of the properties of representative extrusion grades of ethylcellulose (Ethocel) plastic. A wide variety of colours is available in transparent, translucent and opaque types. C.

**Plastic Laminates and Plywoods: Use in Aeroplane Construction.** Y. I. Zhibitskiĭ. *Aviapromyshlennost*, 1941, No. 4, 2-5 (through *Khim. Referat. Zhur.*, 1941, 4, No. 7-8, 116 and *Chem. Abstr.*, 1944, 38, 809). Plastic building materials are prepared by saturating fabrics (Textolite) or paper (Hetinax) with resin, drying and compressing at 120-150° and a pressure of 70-120 kg./sq. cm. The heat capacity of Textolite is one-third and its thermal conductivity  $\frac{1}{10}$ - $\frac{1}{15}$  of that of metal. Textolites with tensile strengths of 18 kg./sq. mm. and a Young's modulus of up to 1700 kg./sq. mm. have been obtained. A 1.5-3.0 mm. layer of Textolite is placed on steel parts. Bakelite plywood is used to cover the wings and fuselage of aeroplanes. Plastics from phenol resin and cellulose dust are used for the construction of sections of wings. Other substances used in the construction of aeroplanes are: a composition from asbestos fibres, kaolin and phenol resin (Absolite); a composition from asbestos ribbon, thin copper or brass net and phenol resin; a stratified plastic composed of asbestos fibres and phenol resins (Asbotextolite). Viamiz, a porous protein plastic of density 0.1 that of felt, is used as sound-insulating material. C.



**(C)—STEAM RAISING AND POWER SUPPLY**

**Boiler Flue Gases: High Dew-point Temperatures.** W. F. Harlow. *Engineering*, 1943, 156, 497-500. Difficulties brought about by acid deposits in the air heaters and economisers of certain modern boiler plants fired by mechanical stokers are due to abnormally high dew-point temperatures of the flue gases caused by excessive sulphur trioxide content. The results of tests in which flue gases were passed over rusty mild-steel scrap show that iron oxide acts as a catalyst for the oxidation of the sulphur dioxide in flue gases, trioxide formation being greatest at temperatures of 1,100° F. "Parkerised" mild steel, nickel-plated mild steel and stainless steel also behaved as catalysts. With mild steel treated by the "Penetral" process (surface of steel converted to aluminium ferride) catalytic action was slight. Samples of external scales from super-heater tubes of two boiler plants burning Durham and Yorkshire coals, respectively, exhibited catalytic properties at high temperatures. Spraying with milk of lime while hot inhibited the catalytic action of iron oxide and super-heater scale. Observations in actual plants are discussed and it is suggested that catalysis due to scale is less important than that due to metal tube surfaces. The influences of temperature, sulphur content of fuel, and steam content of flue gases are discussed. It is suggested that the immunity of pulverised-fuel plants from the troubles studied is due to coating of the heating surfaces with fine dust.

C.

**High-pressure Power and Low-pressure Process Steam Plant.** *Engineer*, 1944, 177, 273-275, 292-294. A detailed description and diagrams are given of plant designed to supply all the power and steam requirements of a large mill operating 24 hours per day, seven days a week, and requiring an electrical output varying from 4000 to 6000 kW, and a process steam output up to 120,000 lb. per hour. The plant includes three mono-tube steam generating units of 65,000 lb. per hour normal full-load capacity, operating at a pressure of 1400 lb. per sq. in., two 3300 kW geared turbo-generators, operating at 1325 lb. per sq. in. and a 4000-kW turbine, heat exchanger plant, high-pressure feed pumps, coal-handling plant, and feed-water arrangements. Operational data relating to analyses of turbine blade deposits, feed-water control, the method of starting up and shutting down the plant, and boiler efficiency tests are presented and discussed.

C.

**Steam Storage Accumulators: Theory.** C. A. Geneve. *Engineering*, 1944, 157, 283-284. A theoretical study of the operation of the Ruth "pressure-drop" type of steam storage accumulator. Equations are deduced and an example is given of the calculation of the changes in the mass of water present with changes in pressure in individual steps of charging and discharging processes.

C.

**(D)—POWER TRANSMISSION**

**American Textile Mills: Electrification.** W. W. Chase. *Textile World*, 1944, 94, No. 1, 56-63. A review of 50 years' progress in mill electrification in the United States. The contrasts between the Columbia Mills in 1894 and 1944 are shown in a series of pictures. Recent developments in other mills are also shown, including electronic control devices.

C.

**Driving Belts: Maintenance.** *Silk and Rayon*, 1944, 18, 342, 442. Practical hints are given on measures to ensure minimum wear of belts, on mounting motors, and on testing the alignment of shafts. Suggested sizes of V-belts for various motor speeds and horse-powers are tabulated.

C.

**Fabric Bushings: Dimensional and Weight Changes in Oil and Water.** R. Nitsche. *Kunststoffe*, 1943, 33, 11-14 (through Mark & Proskauer's *Resins, Rubber, Plastics Abstr.*, 1943, Sheet C; 171.3/816). A report is given of a study of dimensional and weight changes of hard fabric bushings of cotton and cellulose fabric when subjected to prolonged treatment in oil and in water, with and without oil pre-treatment at 100° C. The bushings were made from hard tubing composed of fabric and cresol resin. Tests were made of bushings which had been pressed into a steel collar and of bushings not so mounted. The bushings were held at room temperature for about a year in water or in spindle oil, and the changes in dimensions and weight determined. The results show that the dimensional and weight changes may be two or three times greater for impregnated cotton fabric. The behaviour of bushings appears to depend to a greater

degree upon the resin content than upon the degree of compression. Bushings from tubing which is coiled but not compressed behave better under the influence of oil and water than those from compressed tubing in so far as the resin content is actually higher. Pre-treatment in oil at 100° C. for 7 days effects only temporary improvement in the behaviour of bushings under the influence of oil and water. Conclusions as to the behaviour under oil and water of bushings pressed into a steel collar may be drawn from the results obtained from bushings not so pressed. Short-time tests at room temperature for the determination of the influence of oil and water are misleading, but tests at elevated temperature and pressure give excellent agreement with prolonged tests at room temperature.

C.

**V-Belt Drives: Selection.** H. A. Wilson. *Machinist*, 1944, 87, No. 51, Reference Book Sheet. An Econograph sheave selector chart is presented that enables designers to solve for six variables and determine an economical drive with the fewest V-belts. Advantages of using the largest sheave diameter permissible for a given belt cross-section, consistent with maximum space that can be allowed for the drive are pointed out. The chart gives five families of horse-power curves. Each family of curves gives horse-power at various velocities for a given cross-section of belt when running over stock sheaves ranging from the smallest that will not cause excessive heating to the largest at which no further gain can be realized in power transmitted. The curves show that horse-power capacity of a given cross-section of belt increases with sheave diameter and belt velocity. Totalizing lines for horse-power ratings of standard squirrel-cage motors are superimposed on the chart. In addition, motor-speed lines are drawn through velocity and sheave diameter points. The use of the chart is explained.

C.

**Asbestos Friction Materials: Characteristics.** R. T. Halstead. *Paper Trade J.*, 1944, 118, *TAPPI*, 74-77. The application of friction material to a rotating mechanism is discussed and it is pointed out that the chief result is a conversion of energy of motion into heat energy which in cases of severe service may result in operating temperatures of 1000° F. A suitable material must have a sufficiently high coefficient of friction to perform satisfactorily at all operating temperatures, must not wear too rapidly, and must not abrade the opposing metal surface too rapidly. Coefficients of friction and rate of wear data for standard types of friction materials against various metals are presented and discussed. Other necessary characteristics of friction materials are outlined. The advantages of asbestos for use in friction materials are pointed out and the functions of bonding media, such as rubber and resins, and friction modifiers, such as metals and carbonaceous materials, are discussed.

C.

#### (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Electronic Heating Devices: Industrial Applications.** G. C. Nonken. *Paper Trade J.*, 1944, 118, *TAPPI*, 59-61. The electronic heating of electrical non-conductors is accomplished by placing the materials between plates to which voltages are applied at frequencies of up to 30,000,000 cycles per second. High-frequency electronic oscillators which draw power from any standard alternating-current power source are used. Fundamental equations which are used to predict the size and type of equipment needed are given, and various theoretical and practical considerations are discussed. High-frequency heating has been commercially applied to plywood bonding, the laminating of other thick wooden structures, the pre-heating of plastic preforms prior to moulding, and similar operations where the material to be heated is thick and the time to heat short. Electronic heating of thermo-setting resin-bonded paper plate stock during the curing process is discussed and power factor data are given.

C.

**Infra-red Radiation: Use for Evaporation and Distillation.** J. A. Reavell. *Industrial Chemist*, 1944, 20, 119-130. Types of infra-red generators are briefly described and wave length, temperature, energy and cost considerations are discussed. Applications of infra-red radiation for heating and drying are mentioned. The evaporation and distillation of liquids is studied and infra-red heating is contrasted with methods using steam, heated fluids or hot gases. Conditions of heat transfer in evaporators are examined. Infra-red evaporators designed for use in the laboratory are shown in photographs and diagrams. Satisfactory results obtained in the concentration of various sensitive solutions are reported.

C.

**High-velocity Air Stream: Temperature Measurements.** H. C. Hottel and A. Kalatinsky. *Instruments*, 1944, 17, 40-42. In selecting a method for measuring temperatures in high-velocity streams, the choice has to be made between probes designed to record the true temperature, probes to record the stagnation temperature, and conventional probes accurately calibrated for recovery factor. Since any stationary probe retards the gas in its immediately vicinity, measurement of true temperatures with ordinary probes is not possible. Stagnation temperature measurements have the advantage of yielding more representative data with respect to energy conditions and, in many cases, with respect to heat transfer than intermediate readings obtained with a calibrated conventional probe. The principal advantage of a stagnation probe lies, however, in the considerably improved reproducibility of calibration results. Tests of various probes are reported. A diagram of the equipment is given. The Pratt & Whitney high-velocity stagnation temperature probe was found to be satisfactory for precision measurements. For measurements which do not justify the use of special stagnation probes, the recovery characteristics of commonly-used bare wire thermocouples were investigated. The results indicate that bare wire thermocouples can be used for the great majority of measurements at velocities below 300 ft./sec. C.

**Spectroscopic Hygrometer.** L. W. Foskett and N. B. Foster. *Bull. Amer. Meteorological Soc.*, 1943, 24, 146-153 (through *Sci. Abstr.*, 1943, 46 A, 247). A simple grating spectrophotometer is used with a tungsten filament lamp and projector to measure the precipitable water in the atmosphere. Use is made of the  $1.380\mu$  water-vapour absorption band and the  $1.250\mu$  region for reference. Vacuum thermocouples and high-sensitivity galvanometer are used for energy measurement. Calibration tests were conducted over optical paths of 1.5-52 m. C.

#### (H)—WATER PURIFICATION

**Water Treatment Plant: Maintenance.** H. Nix. *Textile World*, 1943, 93, No. 4, 134-135. Practical hints are given on the maintenance of the motors, pumps and equipment for feeding chemicals of a mill water treatment plant. C.

**Lead: Attack by Water.** E. A. G. Liddiard and P. E. Bankes. *J. Soc. Chem. Ind.*, 1944, 63, 39-48. A critical survey is made of published information and an account is given of a study of the action of distilled water containing known quantities of carbon dioxide on lead, the effects of various additions to the water, electron diffraction examination of films formed on the lead, and the action of various natural waters on lead. The results obtained lead to the conclusion that oxygen plays an essential part in the dissolution of lead by water, the first stage being oxidation of the lead to lead oxide with subsequent formation of lead hydroxide in solution. In distilled or very soft water, containing only traces of carbon dioxide, the first effect on lead is a comparatively heavy attack with the formation of a white precipitate of basic lead carbonate in the water, probably formed by interaction of lead hydroxide with small amounts of carbon dioxide in solution. In time this reaction tends to be suppressed owing to the formation of an insoluble film of basic or normal lead carbonate on the surface of the lead. The formation of this protective film is accelerated by circulation of the water or by increase in the amount of carbon dioxide in the water. The amount of lead going into solution is, however, increased with increase in carbon dioxide content of the water, probably owing to the formation of lead bicarbonate. The presence of sodium or calcium bicarbonate in solution in the water favours the formation on the lead surface of a film which is completely protective even in the presence of carbon dioxide, provided the water is free from chlorides. As little as 40 parts of calcium bicarbonate per million is sufficient to inhibit attack by distilled water containing substantial quantities of dissolved carbon dioxide. The attack on lead by distilled water or bicarbonate solutions, both containing free carbon dioxide, is increased by the addition of sodium chloride. Addition of calcium sulphate to distilled water or solutions of bicarbonate has no effect, and chlorination of distilled water or public supply water has no marked effect on the action of the water on lead. The initial action of distilled water or soft water containing only traces of carbon dioxide can be suppressed by pre-exposure of the lead to solutions of calcium or sodium bicarbonate, but such films have no permanent protective action on waters containing appreciable quantities of carbon dioxide.

Protection against initial attack can also be obtained by pre-treatment with sodium silicate or sodium sulphide. Treatment with solutions of phosphates, sulphates and sulphites gives no initial protection. C.

#### PATENTS

**Dust Removing Appliance.** Dallow, Lambert & Co. Ltd. and J. E. Dallow. B.P.559,827 of 7/1/1943:7/3/1944. An appliance for removing dust and other impurities from manufacturing operations, comprises a nozzle applied to a tubular arm universally jointed with a pipe or duct and connected with a suction fan or blower, and a rigid support which serves to carry the pipe or duct and is fixed either directly or through an intermediate part upon a floor or the ground. In conjunction with this appliance there is used a suction fan which forms part of a unit including a separator or filter for separating the dust or other impurities from the air. The tubular arm is preferably telescopic and the nozzle is preferably jointed to the arm so that it can be adjusted to various angular positions. C.

**Cation-exchange Materials: Preparation and Use.** Permutit Co. Ltd. and E. L. Holmes. B.P.559,941 of 10/9/1941:13/3/1944. Cation-exchange materials consisting of sulphonated carbonaceous materials such as coal, peat, cellulosic substances, starch, sugar and related products, tar, fats, etc., or sulphonated synthetic resins of the phenol-aldehyde type are heated with an aqueous solution of a sulphiting agent to increase the cation-exchange capacity. The sulphiting agent may be a sulphite, bisulphite or metabisulphite. Resins are preferably treated at temperatures of 110 to 150° C. With sulphonated carbonaceous materials the best results are obtained by treatment with sodium metabisulphite at temperatures of 120-125° C. The products may be used for the treatment of water or other liquids. C.

**Low-density Fibre Board: Production.** Minnesota and Ontario Paper Co. U.S.P.2,332,369. A suspension of fibre is mixed with waste lignocellulose cooking liquor and the pH is adjusted to the iso-electric point. The mass is then agitated and aerated so that a stable foam is developed. The mass is made into a structural unit and dried. The material has a density of about 12 oz. to 5 lb. per cubic foot. C.

**Ferrous Metals: Protection against Corrosion.** E. I. Du Pont de Nemours & Co. U.S.P.2,333,206. The metal is coated with an alkylamine of at least 8 C atoms at the rate of 1 lb. per 10,000-80,000 sq. ft. of surface. The process may be applied to oxidised surfaces of ferrous metals after pre-treatment with phosphoric, chromic, molybdic or oxalic acid or one of their acid salts. C.

**Waxed Glass Fabric Liner and Gasket Sealing Material: Production.** Merck and Co. Inc. U.S.P.2,333,535. A tightly woven glass fabric having fibres of about 0.00025 inch diameter and weighing about 1.4 lb. per sq. yd. is impregnated with 40-75 per cent. by weight of wax. The unwaxed fabric is specified as having an air permeability of about 30 cub. ft. per min. per sq. ft. under 1 inch water pressure, and water permeability of about 286 gallons per minute sq. ft. under 10 lb. water pressure per sq. inch. The wax has a viscosity of 62.7 seconds at 210° F., melting point 170° F., and needle penetration of 0.12 cm. at 77° F., and is free from carbonizable matter, free fatty acids, esters, odour or taste. C.

### 9—PURE SCIENCE

**Insect Pests: Control by Fumigation.** E. A. Back and R. T. Cotton. U.S. Dept. Agric. Circ. No. 369, 1942, 63 pages. An illustrated review of general mill or warehouse fumigation; the use of vaults for fumigating products, e.g. clothing; vacuum plant for tobacco, sweets, etc.; and fumigation of specific products. The toxic agents used and their production are described. Respirators should be worn in most cases and first-aid measures in case of accidents with prussic acid are set out. C.

**West Indian Dry-wood Termite: Control.** G. N. Wolcott. *Caribbean Forester*, 1943, 4, 145-157 (through *Tropical Agriculture*, 1944, 21, 14). The West Indian dry-wood termite, *Cryptotermes brevis* (Walker) is able to live in dry wood within houses and does not construct exposed nests. West Indian mahogany is unpalatable to this termite. When small samples of the very susceptible wood

of *Bursera simaruba* were dipped in solutions of various inorganic compounds and then made available to the termites, along with untreated mahogany and other woods of known susceptibility, samples dipped for 10 min. in a solution of approximately half an ounce of either copper sulphate, zinc chloride, barium chloride, or cadmium nitrate per gallon of water became more resistant to attack than mahogany. Treatment of new furniture with such solutions previous to painting or varnishing would provide cheap protection. Since arsenic is toxic but not repellent, the introduction of a 0.3 per cent. arsenic solution into the tunnels of infested wood might not only kill the present colony but prevent reinfestation. C.

**Air Sampling Flowmeter.** H. M. Lemon and H. Wise. *Science*, 1944, 99, 43-44. A small flowmeter designed to be attached to the upstream end of any air sampling device is shown diagrammatically. A constricting orifice, 4 mm. inside diameter and 10 mm. long, in a tube 6 mm.  $\times$  48 mm. gives a satisfactory change in static pressures for air flows between 0.33 and 1.30 cu. ft. per min. This change in static pressure is measured by a glass manometer (4.5 mm. inside diameter and 120-150 mm. long) filled either with water or a 1 per cent. solution of a suitable detergent with a few drops of phenol red added for colouring; the detergent inhibits mould growth and improves the wetting of the glass. Graph paper ruled in millimetres backed by a wooden tongue depressor blade and bound to the manometer with transparent cellulose tape provides a simple scale. Any non-corroding metal or chemically inert plastic, such as Plexiglas, may be used in the construction of the flowmeter. For calibration, the flowmeter should be attached upstream to a standard wet-gas meter or a previously calibrated Venturi meter. C.

**Automatic Acidity Recording Apparatus.** *Silk and Rayon*, 1944, 18, 331-332. An account is given of an automatic titration unit with the following main features. The sample to be titrated is arranged to discharge itself into a beaker, fitted with stirring apparatus and standing on a revolving table, at regular intervals (say, every 3 minutes). It then closes a circuit which releases a spring to open the burette tap. The standard solution flows in until a colour change occurs, whereupon a thalofide cell causes the tap to be turned off. A beam of light is then momentarily operated by means of a shutter to project the image of a float in the burette on a calibrated film. The film is run through a developer, actuated by a time-lag, and gives burette readings in white on a dark background. The burette then fills again and the contact of the float at the top shuts off the feed. A pump empties the beaker. C.

**Glass Electrode Valve Amplifier.** Chun-yu Lin. *J. Sci. Instruments*, 1944, 21, 48-49. A simple valve amplifier for measuring glass electrode potentials is described and shown diagrammatically. The system is characterised by high gain of voltage amplification, great flexibility and economy of power supply. C.

**Titrimetric Analysis Solutions: Standardisation; Volume Measurements.** W. M. Thornton, Jr. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 50-53. Factors influencing the accuracy of measurements of volume, particularly the effects of the thermal expansion of liquids are discussed. Burettes designed for accurate measurements are described and calibration data are given. Procedures for the standardisation of potassium permanganate, borax, and sodium hydroxide solutions are outlined and experimental data showing the high degree of accuracy obtainable are presented. C.

**Iron: Determination.** J. L. Henry and R. W. Gelbach. *Ind. Eng. Chem. Anal. Edn.*, 1944, 16, 49. Potassium dichromate, with diphenylamine sulphonic acid as indicator, can be used in place of ceric sulphate in the determination of iron by the Walden silver reductor method. Hydrochloric acid (1N.) is used instead of sulphuric acid. Details of the procedure and results showing the effects of added impurities are given. Mn, Cr and Ti do not interfere and V does not interfere in concentrations of 100 mg. or less in 200 ml. of titrating solution. C.

**Mahogany Soaps: Adsorption Analysis.** J. M. Koch. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 25-28. For the analysis of mixtures of petroleum oil and oil-soluble sodium sulphonates (mahogany soaps) produced in the manufacture of medicinal white oil, a sample is dissolved in petroleum naphtha and the solution passed through a column of Attapulugus clay. The oil is carried through by

the naphtha and can be weighed after evaporation of the solvent. The sulphonate adsorbed by the clay is removed by washing with methyl alcohol and weighed after evaporation of the latter. Any resinous material in the sample is also adsorbed by the clay from which it can be removed by the use of ethyl acetate or diethyl ether before the treatment with methyl alcohol. Alternatively, if it is only necessary to determine the sodium sulphonate content and the total amount of oily or inactive matter in the sample, a suitable resin eluant may be used as solvent in place of the petroleum naphtha and the oil and resin determined together in the first percolate. The results of analyses of mixtures of known composition show that the method gives accurate results. C.

**Pectin: Determination.** E. F. Bryant, G. H. Palmer and G. H. Joseph. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 74-76. Details are given of an improved pentose-furfuraldehyde method for the determination of pectin in biological materials which involves steam distillation from 85 per cent. phosphoric acid and determination of the furfuraldehyde in the distillate by the aniline acetate reaction. Colour measurements are made with the photo-electric colorimeter or the Duboscq-type colorimeter. C.

**Pectin and Pectic Acid: Determination by Electrodeposition.** K. T. Williams and C. M. Johnson. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 23-25. Details are given of a procedure and apparatus for the determination of soluble pectin in which the solution is freed from electrolytes by the use of ion-exchange resins and is then subjected to electrolysis so that the pectin is deposited at a platinum anode in a weighable form. Results obtained in the analysis of fruit extracts are presented. The results obtained are higher than those obtained by the calcium pectate method. Pectic acid in fruit extracts can be determined by electrodeposition after subjecting the extracts to acetone purification and hydrolysis and removing the electrolytes. C.

**Phenol and Cresols: Identification.** W. B. Deichmann. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 37-38. Qualitative tests employing ferric chloride, hypochlorite, and the reagents of Melzer, Millon, Liebermann, Guareschi, and Cotton are described. A single test or a combination of several of these colour tests can be used for the identification of phenol or *o*-, *m*-, or *p*-cresol, if the unknown solution contains only one of these compounds. C.

**Amorphous Cellulose: Determination by Thallous Ethylate Method.** A. G. Assaf, R. H. Haas and C. B. Purves. *J. Amer. Chem. Soc.*, 1944, 66, 59-65. Cotton linters, highly swollen in caustic soda and dried through methanol and benzene, were immersed in a large excess of 0.1N. thallous ethylate solution. The thallium cellullosate so formed was methylated with excess methyl iodide in benzene. The methoxyl content of the product was accepted as proportional to the percentage of the cellulose wetted by the particular liquid in which the thallous ethylate was dissolved. The extent of the methylation did not depend upon the molecular volume of normal hydrocarbon solvents for the thallous ethylate, but the relationship was inverse and linear for the normal ethers from diethyl to di-*n*-amyl. Branched chain or cyclic ethers and hydrocarbons penetrated the cellulose less efficiently than their normal analogues and thallations in alcohols, although reproducible, were thought to be incomplete. Amorphous cellulose was defined as the percentage wetted by an ether of zero molecular volume and was estimated by extrapolating the linear methylation-molecular volume plots of three or more straight-chain ethers. An extrapolation of the similar plot for the normal alcohols from ethyl to hexyl tended to confirm the result, which was probably within  $\pm 10$  per cent. The amorphous fractions of swollen linter samples were as high as  $27 \pm 2$  per cent., but the amount present in unswollen fibres was of the order of 0.25 to 0.5 per cent. The corresponding colloidal surfaces, ranging from  $520 \times 10^4$  to  $5$  or  $10 \times 10^4$  sq. cm. per g., were not inconsistent with published estimates based upon other experimental methods. C.

**Cuprammonium Cellulose and Glucoside Solutions: Optical Rotation.** R. E. Reeves. *Science*, 1944, 99, 148-149. The high (laevo) optical rotation of cellulose in cuprammonium hydroxide solution is believed to be a property of a complex formed by a copper-containing radical and free hydroxyl groups of cellulose.  $\beta$ -Methyl glucoside dissolved in cuprammonium hydroxide solution is not laevo-rotatory but  $\beta$ -methyl-4-methyl glucoside, which possesses the same

free and substituted positions as cellulose, shows optical activity remarkably like that of cellulose. Observations with other methylglucosides substituted in various positions indicate that free hydroxyl groups in positions 2 and 3 and substitution in position 4 are essential for complex formation. The lævo-rotatory complex appears to be a cyclic structure involving hydroxyl groups on glucose carbon atoms 2 and 3. C.

**Corn Stalks: Oxidation with Alkaline Nitrobenzene.** R. H. J. Creighton and H. Hibbert. *J. Amer. Chem. Soc.*, 1944, **66**, 37-38. Oxidation of corn stalks by nitrobenzene and alkali gives, as actual pure products, vanillin, syringaldehyde and *p*-hydroxybenzaldehyde in yields of 4.5, 2.6 and 1.4 per cent., respectively, based on the Klason lignin content of the corn stalks, the crude yields being 5.3, 3.2 and 1.8 per cent. This represents the first isolation of free *p*-hydroxybenzaldehyde from lignin. Its presence may serve as a distinguishing characteristic between the mono- and di-cotyledons. C.

**Lignin-type Substances: Oxidation with Chromic Acid.** W. S. MacGregor, T. H. Evans and H. Hibbert. *J. Amer. Chem. Soc.*, 1944, **66**, 41-44. Chromic acid oxidation of oxygenated side-chain phenylpropane derivatives related to lignin yielded 80 to 95 per cent. of the theoretical amount of acetic acid thereby providing a method for the determination of —CMe groupings in such products. Oxidation of spruce and maple woods showed that the native lignin present in each wood does not contain an appreciable quantity of end methyl groups. A difference between extracted, amorphous spruce and maple ethanol lignins was observed, in that the former was found to contain an appreciable quantity of —CMe groupings (one for each four or five  $C_6-C_3$  units) whereas the latter contained few or no such groups. Repeated ethanolysis of spruce ethanol lignin effected an increase in the proportion of terminal methyl groups. Strong experimental support is thus found for the theory that native lignin is characterized by the absence of terminal methyl groups and that their presence in extracted lignins is the result of intramolecular changes undergone by very reactive side chains such as are present in hydroxyconiferyl alcohol. C.

**Plant Materials: Taxonomic Classification by Oxidation with Alkaline Nitrobenzene.** R. H. J. Creighton, R. D. Gibbs and H. Hibbert. *J. Amer. Chem. Soc.*, 1944, **66**, 32-37. Alkaline nitrobenzene oxidation of 47 widely varying accepted forms of gymnosperms and angiosperms (including various types of wood, jute fibre, bamboo, rye straw and corn stalks) has shown that in practically all cases the former yield only vanillin, whilst the latter give both vanillin and syringaldehyde. The yields of vanillin, in the gymnosperms, vary between 15 and 24 per cent., based on the Klason lignin. With the angiosperms the combined yield of vanillin and syringaldehyde amounts to 35.51 per cent., the ratio of the former to the latter being approximately 1:3. Considering the highest combined aldehyde yield (silver maple 51 per cent.) obtained, this amounts to 61 per cent. of the Klason lignin based on the assumption that the native maple lignin is derived essentially from a mixture of anhydro polymeric forms of coniferyl and syringyl alcohols. Exceptions to the above ratio (1:3) of mixed aldehydes were found in the case of certain primitive angiosperms characterised by the absence of vessels, the ratio in this case being 1:1. All genera of the *Gnetales* (a group of uncertain position) gave both vanillin and syringaldehyde on oxidation, a result in harmony with their high lignin and methoxyl values and behaviour with the Mäule reagent. Their relationship to the angiosperms rather than to the gymnosperms is thus indicated. Only a very few members of the *Coniferales* were found to yield, on oxidation, an aldehyde mixture containing both vanillin and syringaldehyde and to give a definite Mäule reaction. The behaviour on oxidation of all the plants investigated is in complete agreement with their colour reaction (or its absence) when tested with the Mäule reagent, and thus offers a new chemical procedure for taxonomic classification. C.

**Starch Modification B: Structure.** R. E. Rundle, L. Daasch and D. French. *J. Amer. Chem. Soc.*, 1944, **66**, 130-134. Methods of preparing films and fibres of the "B" modification of starch are outlined and X-ray diffraction data are discussed. A unit cell with  $a_0=16.0$ ,  $b_0=10.6$ ,  $c_0=9.2$  Å. is found for the "B" modification. The structure is probably orthorhombic. A rough structure is proposed. It is pointed out that, in contrast to cellulose, the configura-



tion of the starch chain depends upon how the starch is treated and that plasticizers generally alter the starch structure considerably. C.

**Pyrodextrins: Structure.** B. Brimhall. *Ind. Eng. Chem.*, 1944, **36**, 72-75. Pyrodextrins are degradation products of starch obtained by roasting, either alone or in the presence of small amounts of catalytic agents. The properties of a commercial water-soluble pyrodextrin (a British gum) are described and shown to be in harmony with a molecule containing approximately 66 glucose residues arranged so that there are four or five short branches of approximately five glucose units each. The branched (amylopectin) and unbranched (amylose) components of corn-starch, as well as amylopectin, retrograded starch, and ordinary granular starch, have been dextrinized and the course of conversion has been followed by water solubility, reducing power, and digestibility with  $\beta$ -amylase. The results indicate that the linear portions of starch become branched during the heating process, as demonstrated by loss of ability to retrograde, increased resistance toward  $\beta$ -amylase, and percentage of tetramethyl-glucose upon hydrolysis of the methylated product. A possible mechanism for heat dextrinization is discussed. C.

**Amino Acids: Colour Reactions.** H. Tauber. *J. Amer. Chem. Soc.*, 1944, **66**, 310. Certain amino acids are converted to chromogens when heated. Alcoholic extracts containing these chromogens become more deeply coloured when alkali is added, but on subsequent acidification become colourless or much paler. *l*-Tyrosine, *l*-tryptophan, and *dl*-threonine turn reddish brown on heating, exhibit a light brown or reddish brown in alcoholic solution, become more deeply coloured on the addition of alkali and turn a light brown, or, with *l*-tyrosine, a yellow colour on acidification. *l*-Histidine mono-hydrochloride becomes light brown on heating, light yellow in alcoholic solution, deep yellow on the addition of alkali and almost colourless on acidification. *dl*- $\beta$  or *l*- $\beta$ -Phenylalanine and *l*-leucine on heating partially sublime, turn yellow and give a yellow or light yellow colour in alcoholic solution. This turns to a deep yellow on addition of alkali and becomes almost colourless on subsequent acidification. With the  $\beta$ -phenylalanines, the alkaline alcoholic solution exhibits a greenish-yellow fluorescence, which is particularly strong in ultra-violet light, without the addition of alkali. On heating, *l*-cystine, *l*-cysteine, glycine, *l*-hydroxyproline, *dl*-methionine, glutamic acid, *dl*-aspartic acid, *dl*-serine, *l*-proline, *d*-arginine mono-hydrochloride, *dl*-lysine and *d*-lysine change to yellow, brown or black decomposition products without chromogenic properties. *dl*-Alanine, *dl*-valine and *dl*-iso-leucine sublime completely leaving no pigment or residue. C.

**Antioxidants: Properties.** F. Bergel. *Chemistry and Industry*, 1944, 127-128. A discussion of the preparation, antioxygenic activity and other properties and uses of antioxidants of the quinol and pyrogallol groups, dienols,  $\omega$ -hydroxy-hydroxyacetophenones, and nitrogen-containing inhibitors. It is pointed out that quinols, pyrogallol and dienol derivatives have so far proved to be the most effective and practical stabilizers. C.

**Benzoquinone and Anisole Derivatives: Resonance Effects.** H. H. Hodgson. *J. Soc. Dyers & Col.*, 1944, **60**, 65-67. The melting point order and variation of colour of the 2-halogenbenzoquinones are interpreted on resonance theory, which also satisfactorily accounts for melting point regularity among the 3-halogenbenzoquinone-4-oximes. Benzoquinone-monoximes and their ethers always melt at higher temperatures than the tautomeric nitrosophenols and ethers, due to predominance of a more highly polarised resonance structure. The effect of fluorine in controlling the nitration of 3-fluoroanisole and of its mononitro-derivatives may be readily explained by resonance structures, and the argument thus developed is applied satisfactorily to the order of replacement of all three chlorine atoms by nitro-groups when 3-fluoro-2:4:6-trichloroanisole is treated with fuming nitric acid at 0° C. C.

**Dilinoieic Linear Superpolyesters: Preparation.** J. C. Cowan and D. H. Wheeler. *J. Amer. Chem. Soc.*, 1944, **66**, 84-88. Superpolyesters were prepared from the unsaturated dibasic acid, dilinoieic acid, with ethylene, decamethylene and hydrogenated dilinoieyl glycols. Loss and decomposition of ethylene glycol occurred at reaction temperatures and therefore superpolyesters from ethylene glycol were only obtained when excess of glycol was used and the final stages of the reaction were effected by glycolysis. Superpolyesters having molecular



weights of 20,000 or more were obtained by direct esterification when decamethylene and hydrogenated dilinoleyl glycols were used. A study of the variation of viscosity with molecular weight showed a straight-line relationship between log. viscosity and square root of molecular weight up to molecular weights of 10,000 on certain polyesters. Direct comparison of superpolyesters from dilinoleic acid and from hydrogenated dilinoleic acid demonstrated that reaction conditions can be controlled so that non-conjugated unsaturation does not cause cross-linking of chains. C.

**Unsaturated Fatty Acid Chlorides: Preparation.** T. R. Wood, F. L. Jackson, A. R. Baldwin and H. E. Longenecker. *J. Amer. Chem. Soc.*, 1944, 66, 287-289. Oleyl, elaidyl, linoleyl and linolenyl chlorides were prepared by the action of oxalyl chloride on the corresponding pure acids. Linoleic and linolenic acids and the corresponding chlorides were examined spectrophotometrically. The results demonstrate that the reaction of the acids with oxalyl chloride was not accompanied by rearrangements of the double bonds to produce conjugated systems. C.

**Cellulose: Electrokinetic Properties and Surface Conductivity.** Gertrude Rabinov and E. Heymann. *J. Phys. Chem.*, 1943, 47, 655-668. Experimental conditions and theoretical considerations affecting streaming-potential measurements with cellulose are discussed and a report is given of investigations of the electrokinetic properties and surface conductivity of purified cotton, cotton wool, oxycellulose, mercerized cellulose, and regenerated cellulose. The results show that in distilled water the  $\zeta$ -potential decreases and the surface conductivity increases with increasing carboxyl-group content of cellulose. Substitution of carboxyl H by Ca and Na lowers the surface conductivity, but affects the  $\zeta$ -potential little. A theoretical interpretation of these results is given. It is shown that a maximum observed in the  $\zeta$ -potential/concentration curve for alkali chlorides is not due to a dispersion of the surface conductivity. For uni-univalent and bi-univalent electrolytes the surface conductivity shows a marked increase with concentration whilst the  $\zeta$ -potential decreases. The difficulty of reconciling the increase of surface conductivity with a simultaneous decrease of  $\zeta$ -potential is pointed out, and two tentative explanations are suggested. C.

**Polyamide Solutions: Viscosity-Chain Length Relationship.** A. Matthes. *J. prakt. Chem.*, 1943, 162, 245 (through Mark & Proskauer's *Resins, Rubber, Plastics Abstr.*, 1943, Sheet C2:163). Polymers of  $\epsilon$ -aminocaproic acid with degree of polymerization below 50 were prepared by lactam polymerization in the presence of from 10 to 300 per cent. (on lactam) of water. For end group determination amino nitrogen was determined by the van Slyke method. Viscosities of 1 per cent. (by vol.) solutions in pure sulphuric acid and in 40 per cent. sulphuric acid were determined with the Ubbelohde viscometer. Solutions (1 per cent. by vol.) of technical fibres of  $\epsilon$ -aminocaproic acid polymers (Perlon L) in 40 per cent. sulphuric acid were heated to 50° C. for periods from 5½ to 184½ hours. The viscosity was measured at 20° C., and the degree of polymerization calculated by means of formulae obtained by correlating viscosity data with results of end-group determinations. The degrees of polymerization thus calculated were correlated with those to be expected from kinetic considerations. The results indicate the applicability of the parabolic relationship  $[\eta] = K \cdot P^a$  for the viscometric molecular weight determination of  $\epsilon$ -aminocaproic acid polymers, including the higher polymerized technical products. According to this equation, the degree of polymerization of Perlon L exceeds 200. The values found for the exponent  $a$  indicate that the polyamide molecules in solution are unbranched but highly curled. C.

**Starch-Iodine Complexes: Absorption Spectra.** R. R. Baldwin, R. S. Bear and R. E. Rundle. *J. Amer. Chem. Soc.*, 1944, 66, 111-115. Differences in the transmission curves of the iodine complexes of amylose and amylopectin materials and the possibilities of colorimetric analysis of starch for amylose and amylopectin are discussed. The amount of iodine bound in complex formation with amylose increases as the concentration of iodide decreases, becoming one iodine molecule for six glucose residues for infinitely dilute iodide solutions. The wave length of maximum absorption of an amylose-iodine solution shifts toward the red as the chain length of the amylose is increased. The shift is in the same direction when the lengths of the unbranched portions of amylo-

pectin are increased. An increase in the molecular extinction coefficient accompanies an increase in the length of amylose or an increase in the lengths of unbranched portions of amylopectin. Both these properties permit the relative evaluation of molecular weight of an amylose or degree of branching of an amylopectin, the change in molecular extinction coefficient being the more sensitive. Data and curves are given for iodine complexes of amyloses and amylopectins of different origins. C.

**Photo-electric Photometer.** J. McG. Sowerby. *J. Sci. Instruments*, 1944, 21, 42-45. Diagrams and a detailed description are given of a photo-electric photometer for measuring the light scattered at about  $45^\circ$  from the surface of a transparent plastic which has suffered abrasion. The abraded portion of the plastic is illuminated by a low-voltage lamp via a lens system, and the scattered light falls on a sensitive vacuum photo-cell coupled to an amplifier. The amplifier drives a tuning-eye whose shadow is always returned to a given mark, and the adjustable element is a scaled potentiometer. C.

**Colour Harmony: Geometric Formulation.** P. Moon and Domina E. Spencer. *J. Optical Soc. America*, 1944, 34, 46-59. A scientific development of the classical theories of colour harmony is presented. The qualitative ideas of artists and colour specialists are incorporated into a quantitative system depending on the C.I.E. colour specification and its transformation into a metric colour-space. The entire theory is based on two postulates: pleasing intervals and ambiguous intervals exist between colours, and an orderly geometric arrangement of colour-points leads to harmony. On this foundation is built a classification of harmonies and these harmonies are tabulated in some detail. The combinations are by no means equally pleasing, but elements of order can be discerned in all of them. Divisions into regions of similarity, ambiguity, contrast and glare are made which are in accordance with classical colour harmony, but the numerical designations of these regions are new and are based on preliminary experiments. The advantage of the method is that it gives the designer a wealth of new harmonies from which he can select the particular one best fitted to his needs. Classical colour harmony is confined to relations among colours, irrespective of area. In the present paper conditions are simplified to agree with classical theory. Areas are kept equal, adaptation is fixed at a neutral gray of Munsell value 5, and no attempt is made to compare the various harmonies aesthetically. C.

**Solids: Orthogonal Projection; Photographic Method.** P. Lake. *British J. Photography*, 1944, 91, 129-132. In examining fossils which have been distorted by pressure it has sometimes been possible to determine the amount and kind of distortion with considerable accuracy and to prove that an orthogonal projection of the distorted specimen would have the same proportions as the specimen had before distortion. The preparation by the ordinary methods of a drawing which will show the original form is laborious, and it has been found possible, without exceptional cameras or lenses, to obtain a photograph which would have the same proportions as the orthogonal projection. A detailed explanation of the method is given. C.

**Fine Particle Measuring Instrument.** Fisher Scientific Co. *Laboratory*, 1943, 14, 63-65. The determination of the size of particles of sub-sieve range in the Fisher "Sub-Sieve Sizer" is based on measurements of resistance to air flow by packed particles. A motor-driven air pump builds up pressure in a pressure regulator to a constant head so that a uniform flow of dry air passes through the packed powder sample. The flow of air is measured by means of a double range flow meter. The average particle size corresponding to the observed liquid level in the manometer is read directly from a chart. The range of measurements is from 0.2 to  $50\mu$ . C.

**Elastomers: Young's Modulus; Effect of Low Temperatures.** J. W. Liska. *Ind. Eng. Chem.*, 1944, 36, 40-46. Methods and apparatus are described for bending and brittleness tests at low temperatures. Data showing the variation with temperature in the range  $0^\circ$  to  $-60^\circ$  C. of Young's modulus for natural and synthetic rubbers are presented and discussed and the effects of freezing time are considered. The results indicate that extremely long test periods are required for the investigation of physical changes resulting from low-temperature crystallization. The rubber stocks having relatively high moduli at a given low

For disinfection the chlorophenols with the greatest application are the chloro-xenols, and *p*-chloro-*m*-xylenol has been widely used. Mixed chlorinated xylenols prepared from wider cuts of distillation products are available. These mixed products always contain a proportion of unchlorinated xylenols, but by careful manufacture the latter can be kept within the 1 per cent. tolerance for medicinal products. For the so-called non-poisonous disinfectants for sale through general channels, however, only pure *p*-chloro-*m*-xylenol or other legally non-poisonous substances can be used, in compliance with the law. C.

**Rot-proofed Fabrics: Free Copper Compound Contents.** O. A. Samsonova. *Tekstil. Prom.*, 1943, No. 1/2, 15-18 (through *Chem. Abstr.*, 1944, 38, 1120<sup>9</sup>). Impregnated fabrics may contain copper and chromium tannates, aluminium soaps, aluminium and iron tannates and copper soap. Further, the treatment is followed by a neutralising bath of a sodium carbonate solution, in consequence of which there is the opportunity for the formation of aluminium hydroxide and basic copper carbonate. The author investigated the formation of copper compounds. To simplify the problem, aluminium acetate was omitted. The following mixtures were prepared: (1) tannins, copper sulphate and dichromate, (2) basic copper carbonate, and (3) solutions of copper sulphate, dichromate and sodium carbonate. The reaction between the tannins and copper sulphate proceeds slowly and does not go to completion, whereas dichromate reacts completely. The reaction between copper sulphate and sodium carbonate proceeds rapidly and practically completely. When two baths are used, copper may form tannates, soap and basic carbonate. Of these the first two are not stable toward water-extraction, whilst the third is stable. If it is assumed that the reaction between the tannin and dichromate involves the oxidation of the tannin and reduction of chromium and that the reduced chromium forms the tannate, then the tests prescribed by the VTU (standards) would be always negative, since precipitation with lead acetate reveals only chromic salts. Results of studies on the effect of cleaning of the fabric on the formation and retention of free copper salts, and of the effect of solutions of copper salts on strength and ageing, are tabulated. Copper compounds are extracted with boiling water because of the insufficient stability of copper tannates and soaps and of combinations of copper and linen fibres. Therefore the greater the copper content in the fabric the more "free copper compounds" may appear. If the presence of appreciable quantities of free copper compounds is an indication of considerable copper fixed in the fabric, then the test is possible, since a large quantity of fixed copper in the fabric contributes to the strength and durability of the fabric. Actually no limit can be set for the amount of free copper compounds in a fabric since this limit would depend on the amount of copper applied to the fabric. C.

**Leather: Mildew Proofing.** R. M. Lollar. *J. Amer. Leather Chem. Assoc.*, 1944, 39, 12-24. An interim report is given of tests of the protective power of some 38 antiseptics (branded products and known chemicals) for leather in exposures to a mixed infection of moulds at 95-100° F. and 85-95 per cent. R.H. Patch tests were also done to check the possible danger of dermatitis due to wearing such protected leather. It is recommended to make field trials with 0.5 per cent. of *p*-nitrophenol and *p*-chloro-*m*-xylenol or *p*-chloro-*m*-cresol. Salicylanilide is said to merit further study. "Preventol I" (trichlorophenol in triethanolamine) is effective, but possibly harmful to leather because of its alkalinity. Organic mercury compounds are rather irritating to the skin. Sulphated castor oil appears to be a good vehicle for applying antiseptics to leather. C.

**Rubber: Use for Protection from Mustard Gas.** T. R. Dawson and R. W. Parris. *J. Rubber Research*, 1944, 13, 33-48. This report summarises published information on the manufacture of gas-protective material from rubber, rubber derivatives, synthetic rubber-like materials and non-rubber materials, types of gas-protective articles (gas masks, clothing, boots, and joint-sealing for gas-proof chambers), the behaviour of rubber towards mustard gas, methods of testing the permeability of rubber or other material, and the resistance of paints, specifications for the different types of gas-protective products, and the decontamination of tyres, electrical equipment, rubber and oilskin clothing and respirators, and leather. C.

**Sodium Borophosphate: Application in Flame-proofing.** *Silk and Rayon*, 1944, 18, 445. Sodium borophosphate is described as a clear, syrupy liquid that forms a thin, transparent film over a fibre and is an efficient flame-proofing agent. It is dissolved in water (1 pint to 6-11 pints of water, according to the fabric) for application in open tanks or a spray may be prepared from 17 lb. of the agent, 15 gallons of water, and 2 oz. of a wetting agent. C.

**Water-repellent Finishes: Use of Wax Emulsions.** J. V. Steinle. *Text. Col.*, 1944, 66, 11-12. A survey of the advantages of wax emulsions as water-repellent coatings for fabrics. They have been successfully combined with mildew-proofing agents. W.

#### PATENTS

**Fur: Carrotting.** The Non Mercuric Carrot Co. B.P.559,464 of 21/2/1944. A carrotting solution is mixed with neutral, highly-absorbent and powdered material which is non-reactive to the solution, e.g. sawdust, natural and synthetic ground sponge, powdered asbestos, etc. The powdered material is also mixed with penetrators, e.g. sand, ground or powdered abrasives, and ground stone, not containing carbonates. The concentration of the carrotting solution must be increased 30-50 per cent. over that used in the normal brushing method. The carrotting effect is improved by the addition to the solution of glue, gelatin or furfural. The carrotting mixture is applied to the skins by tumbling, with which drying may be combined; the dry material is mechanically shaken from the skins and recovered for further use. W.

**Fulling or Planking Machines, especially for Hat Bodies and Hats.** V. C. Böhm. B.P.559,675 of 1/3/1944. The number of points of contact and thus the production of a fulling machine is increased by allowing a main roller of greater diameter to co-operate with secondary rollers of smaller diameter arranged at an acute angle to one another, the hat bodies, etc., being fulled by the oscillating motion of the main roller at each point of contact with the secondary rollers. W.

**Delustred Cellulose Derivative Filaments and Films: Production.** British Celanese Ltd. B.P.560,375 of 27/7/1942:3/4/1944 (Conv. 9/8/1941). Filaments or films having a basis of an organic derivative of cellulose and containing polymerised ethylene oxide are subjected to the action of a hot aqueous medium until the desired loss of lustre has occurred. The polymerised ethylene oxide may be added in various amounts, e.g. 1-50 per cent., to the solutions from which the filaments or films are prepared. Delustering of filaments, or of yarns, fabrics or other textile products containing the same may be carried out effectively with water at elevated temperatures, and the aqueous delustering bath may also contain substances such as soaps, salts, acid salts, pine oil or tetrahydronaphthalene, which accelerate or enhance the delustering action. The delustred products show increased affinity for dyes and have excellent strength and crêpeing properties. C.

**Regenerated Cellulose Yarns and Fabrics: Treatment to Increase Capacity for Shrinking.** British Celanese Ltd. B.P.560,378 of 21/9/1942:3/4/1944 (Conv. 20/9/1941). Regenerated cellulose yarns obtained by stretching and saponifying yarns made of an organic ester of cellulose, or fabrics made from such yarns, are treated with a solution containing between 30 and 75 per cent. by weight of a mercerising agent, e.g. caustic soda, and then removing the solution from the treated materials. The treatment increases the capacity of the materials for shrinkage on drying and also improves their extensibility. C.

**Tertiary Amine Derivative Water-repellent Agents: Preparation.** G. M. Clark (Warwick Chemical Co., West Warwick, Rhode Island, U.S.A.). B.P.560,448 of 4/11/1941:5/4/1944. Compounds suitable for rendering textile fibres water repelling have the general formula  $\text{RCOO} \cdot \text{CHR}' \cdot \text{N}(\text{tert.})\text{X}$ , where R stands for an alkyl radical containing not less than 10 C atoms, R' is H or an alkyl radical, X represents halogen or a weak carboxylic acid anion radical, and N(tert.) is pyridine, quinoline, triethanolamine or trimethylamine. Compounds in which X is halogen may be readily synthesized from aliphatic aldehydes, the acid halides of the higher fatty acids such as stearic, palmitic and lauric acids, and a tertiary amine. Compounds in which X is chlorine may also be prepared by reacting thionyl chloride with appropriate

acids and aldehydes and treating the products with a tertiary amine. Compounds in which X represents a weak carboxylic acid anion radical may be made by reacting together the higher fatty acid, thionyl chloride, a weak carboxylic acid and the aldehyde and mixing the resulting product with the tertiary amine. The products dissolve in water to form cloudy, strongly foaming solutions. One per cent. solutions are usually satisfactory for producing a permanent water repelling effect on textile fibres. Fibres or fabrics are immersed in a solution, passed between pressure rollers, dried at room or slightly higher temperature, and then baked in an oven at an elevated temperature. C.

**Azo Dyes: Production.** Society of Chemical Industry in Basle. B.P.560,451 of 3/4/1942:5/4/1944 (Conv. 3/4/1941 and 19/2/1942). Azo dyes are made by coupling in an alkaline medium a diazotised 2-amino-4-chloro-1-hydroxybenzene free from sulphonic acid groups and containing a nitro group as substituent in the 5- or 6-position with an azo dye of given general formula produced by the one-sided coupling of a tetrazotised benzidine with salicylic acid, or a substitution product thereof, and coupling the resulting diazo-azo compound with 2-amino-5-hydroxynaphthalene-7-sulphonic acid in an acid medium. The resulting dyes when after-coppered, give brown to violet-brown dyeings, fast to washing and light. They are suitable for dyeing and printing natural and regenerated cellulose fibres and animal fibres. C.

**Sulphonated Monoazo Dyes: Production.** Society of Chemical Industry in Basle. B.P.560,452 of 23/4/1942:5/4/1944 (Conv. 25/4/1941). Monosulphonated monoazo dyes, which have very good levelling properties and yield dyeings on wool that are fast to light and perspiration, are made by coupling the diazo compound of a sulphone of the general formula  $R_1SO_2R_2$ , in which  $R_1$  and  $R_2$  denote aromatic nuclei of the benzene series, one of which nuclei contains an amino group in meta-position to the  $SO_2$  group, in an acid medium with 2-amino-8-hydroxynaphthalene-6-sulphonic acid. C.

**Water-repellent Finishes: Production.** American Cyanamid Co. B.P.560,532 of 9/7/1942:7/4/1944 (Conv. 30/8/1941). A composition for finishing textiles comprises an aqueous emulsion or dispersion of an alcohol-reacted melamine-aldehyde condensation product, in the presence of a salt of an alkoxypropylamine containing at least 11 C atoms in the cation. The best results are obtained with melamine-formaldehyde condensation products containing from 2.5 and preferably about 4 moles of formaldehyde for each mole of melamine. The condensation products are preferably reacted with lower aliphatic alcohols such as methyl alcohol or butyl alcohol to the solvent-soluble stage, after which suitable amounts of other organic solvents may be added. A suitable alkoxypropylamine salt, preferably a di-(octadecoxypropyl)amine salt, is then dissolved at room temperature in the resin solution and water is slowly added with rapid, efficient stirring until an emulsion of the water-in-oil type having a particle size of  $1\mu$  or less is obtained. For application to fabrics this emulsion is further diluted with about 5 to 10 times its weight of water at 70-120° F. and the cloth is passed through the bath under conditions such that the amount of finish will range from 3 per cent. to 12 per cent. The cloth is then preferably dried at 240-250° F. after which the resin is cured for 4 min. at 285-310° F. or higher. The finished cloth has a soft, full handle and good water-repellency. The finish is stable upon storage and is resistant to laundering and dry cleaning. C.

**Polymeric Ester Coating Materials: Production.** E. I. Du Pont de Nemours & Co. and H. S. Rothrock. B.P.560,663 of 29/4/1942:14/4/1944. Polymers are obtained by heating in the presence of a metallic drier an ester of an unsaturated polycarboxylic acid and an aliphatic unsaturated monohydric alcohol in which alcohol the carbinol group is attached only to a saturated carbon atom. The polymerisation is carried out in thin films in the presence of the metallic drier whereby superior hard, flexible, light-coloured films are obtained. Alcohols useful in making the esters include allyl carbinol and China wood oil alcohol. The acids may be aliphatic, hydroaromatic or aromatic unsaturated polycarboxylic acids. Preferred metallic drier catalysts are the Co, Mn and Pb salts of naphthenic and linoleic acids. The polymeric materials prepared by this method are useful as vehicles for coating, impregnating or adhesive compositions. C.

**Photo-chemical Action Protective Colour Screen.** M. R. Coe (Washington, U.S.A.). B.P.560,714 of 21/4/1942:18/4/1944. A method of inhibiting deleterious or undesirable photo-chemical action on rubber, tobacco, foods, oils, fats, waxes, preparations containing vitamins and enzymes, and other commodities, comprises shielding them by means of a colour screen which is opaque to light having wave lengths between 6300 and 6700 Å. and below 4900 Å., but which will transmit substantially all other light. Screens in the form of protective shields, plates, caps, bags, formed containers or container linings may be used. The screen may be made of translucent or transparent material such as glass, glassine, synthetic resin, cellulosic material, etc., in which suitable dyes or colouring substances are incorporated. Malachite green, Monastral green, Fast green (A-5832) or chlorophyll pigment with the addition of a yellow dye or pigment such as "Azosol" fast yellow (ogga) may be used to produce the desired spectral absorption characteristics. C.

**Vat Dye Printing Preparations.** Durand & Huguenin A.-G. (Basle). B.P. 560,747 of 24/11/1941:19/4/1944 (Conv. 11/12/1940). Vat dye preparations for printing fabrics are made by dissolving in an aliphatic monohydric alcohol, polyhydric alcohol, ether thereof, aliphatic hydroxycarboxylic acid or ester thereof, or thiodiglycol, a cellulose derivative, an ester salt of a leuco vat dye and an oxidising agent and treating the solution with an organic acid, whereby the vat dye is re-formed in a finely divided state from the ester salt. An addition of urea to the solution is advantageous and the addition of a softening agent is advisable. By printing with such preparations and drying in the ordinary way, prints of very good yield, brightness and fastness to rubbing are obtained. C.

**Mordant Dyes: Chroming.** J. R. Geigy A.-G. (Basle). B.P.560,787 of 14/10/1942:20/4/1944 (Conv. 15/10/1941). A process for chroming *o*:*o*'-dihydroxyazo, *o*-hydroxy-*o*'-carboxyazo, or *o*-hydroxycarboxyl dyes, free from sulphonic acid groups, consists in treating such a dye in aqueous solution or suspension at raised temperature with a complex chromium compound of an aromatic *o*-hydroxycarboxylic acid and in doing so using at least one atom of chromium for each mordant grouping of the dye. Water-soluble chromium compounds of the dyes are obtained. The soluble chromium compounds of the *o*-hydroxycarboxy dyes produced in this way may be used for dyeing cellulose e.g. cotton or paper, and for dyeing silk and leather. The chromium compounds of the *o*:*o*'-dihydroxyazo and *o*-hydroxy-*o*'-carboxyazo dyes, free from sulphonic acid groups, draw uniformly, from a weak acid bath, on animal fibres and partially also on cotton. They are also suitable for dyeing leather. C.

**Anthraquinone Dyes: Production.** E. I. Du Pont de Nemours & Co., A. J. Wuertz and D. X. Klein. B.P.560,817 of 15/7/1942:21/4/1944. Anthraquinone dyes are made by condensing halogeno-, nitro-, hydroxy-, or amino-anthraquinones, if desired wholly or in part in the form of their leuco compounds, with *m*-aminobenzyl alcohol or a nuclear-substituted derivative thereof. The dyes are suitable for cellulose acetate fibres, being fast to gas fumes. C.

**Azo Dyes: Production.** Society of Chemical Industry in Basle. B.P.560,842 of 6/7/1942:24/4/1944 (Conv. 5/7/1941 and 11/5/1942). Azo dyes which are capable of development on the fibre are made by tetrazotising an azo dye of given general formula and coupling with two mols of resorcinol or meta-amino-phenol (or one mol of each). In an example, 4-aminobenzene-(1-azo-2')-5'-amino-1'-hydroxynaphthalene-3'-sulphonic acid is tetrazotised and coupled with resorcinol. The product dyes cotton violet-black. Olive-black tints, which are very fast to washing, are obtained by after-treatment on the fibre with 1-diazo-4-nitrobenzene. The developed dyeings can be discharged pure white under neutral or alkaline conditions. C.

**Monoazo Wool Dyes: Production.** W. F. Beech, M. Mendoza and Imperial Chemical Industries Ltd. B.P.560,892 of 18/9/1942:25/4/1944. Chromable monoazo wool dyes are manufactured by coupling diazotised *o*-amino-phenol or -naphthol monosulphonic acids, which may carry simple substituents, such as halogen and nitro, with a 1-diphenyl-3-(methyl or phenyl)-5-pyrazolone wherein the phenyl groups may carry as substituents halogen, alkyl or alkoxy, but are otherwise unsubstituted. The dyes are suitable for application by the

meta-chrome process and yield strong orange-brown to bluish-red dyeings of good fastness to washing, milling, potting and light. C.

**Anthraquinone Dyes: Production.** A. Lowe, A. C. Robson and Imperial Chemical Industries Ltd. B.P.560,988 of 9/10/1942:1/5/1944. Water-soluble dyes of the anthraquinone series are made by treating 4-*p*-benzeneazo-anilinoanthraquinones in which at least one of the 1, 5 and 8 positions of the anthraquinone nucleus is occupied by an acylamino group, the 1, 5 and 8 positions not so occupied being either free from substituents or occupied by a halogen atom, in which the 2 position of the anthraquinone nucleus is either free or is occupied by a halogen atom, an alkyl radical or a sulphonic acid group, and in which the aromatic nuclei of the *p*-benzeneazoanilino group may be unsubstituted or may bear as substituents in any position, provided that not more than one position ortho to the NH group is blocked, hydroxyl, alkoxy, amino, alkyl or nitro groups or halogen atoms, with sulphur trioxide or chloro-sulphonic acid, preferably in sulphuric acid as a solvent, and, if necessary, further treating with sulphonating agents. The dyes dye wool in deep brown shades of very good fastness to light and to washing. C.

**Chlorite and Persulphate Bleach Liquor: Application.** Mathieson Alkali Works (New York). B.P.560,995 of 27/10/1942:1/5/1944 (Conv. 26/9/1941). Cellulosic materials, including wood pulp, cotton linters, rayon, and woven fabrics made from cellulose fibres, can be bleached to an exceptional whiteness and without substantial degradation, by subjecting them to the action of an aqueous solution containing an alkali metal or alkaline earth metal chlorite and an alkali metal or alkaline earth metal persulphate at a pH of about 3-11. Application of this treatment to cellulosic material which has been partially bleached with one or more conventional bleaching agents is particularly advantageous. C.

**Chlorite and Aldehyde Bleach Liquor: Application.** Mathieson Alkali Works (New York). B.P.561,022 of 6/10/1942:2/5/1944 (Conv. 8/10/1941). Cellulosic materials can be bleached to an exceptional whiteness without substantial degradation, by subjecting them to the action of an aqueous solution containing an alkali metal or alkaline earth metal chlorite and an aldehyde at a pH of about 3-9. Specified aldehydes include formaldehyde, acetaldehyde, furfural, benzaldehyde, the 5- and 6-carbon atom aldose sugars and inverted sucrose. Phosphates are preferably used to control the pH of the bleaching solution. The method is applicable to the bleaching of wood pulp, cotton linters, rayon and cellulosic fabrics. A combined operation in which the cellulosic material is partially bleached with one or more conventional bleaching agents and the bleaching completed by treatment with a chlorite and an aldehyde is particularly advantageous. C.

**Metallized Azo Pigments: Production.** Imperial Chemical Industries Ltd. B.P.561,054 of 29/7/1942:3/5/1944 (Conv. 31/7/1941). Metallized azo pigments are made by coupling in aqueous medium a diazotised arylamine or heterocyclic amine which is devoid of hydroxy and of ether groups adjacent to the diazotised amino group, and devoid of sulphonic acid and carboxy groups, with a compound of the 4-hydroxy-2-pyridone series and metallising in an aqueous or aqueous-alcoholic medium by reaction with a water-soluble salt of a divalent metal having an atomic weight of between 50 and 66 in the proportion of one atomic equivalent of the metal to two molecular equivalents of the pyridone radical. The metal salt may be present during the coupling or added after coupling is complete. Suitable compounds of the 4-hydroxy-2-pyridone series comprise 4-hydroxy-2-pyridone which may carry substituents attached to the nitrogen atom which are phenyl, cyclohexyl or alkyl having 1 to 8 carbon atoms, and which may carry substituents in 5- and 6-positions which are alkyl having 1 or 2 carbons, halogen or nitro, or which taken together form with the 5- and 6-carbon atoms an isocyclic ring, which may be substituted by halogen, methyl, methoxy, ethoxy or nitro groups, or may be in the form of a benzo derivative. Products metallised with nickel, cobalt or copper show the best light fastness. C.

**Metallisable Direct Dyes: Production.** J. R. Geigy A.-G. (Basle). B.P. 561,117 of 5/11/1942:5/5/1944 (Conv. 6/11/1941). Metallisable direct dyes are obtained by condensing, in the presence of caustic alkali, an aminoazo dye



of given general formula with a triazole of the type produced by treating with oxidising agents monoazo dyes obtained from diazotised 4-nitro-4'-aminostilbene-2:2'-disulphonic acid by coupling with naphthyl amino derivatives coupling in *o*-position to the amino group. Specified aminoazo dyes include dyes produced by coupling diazotised 2-amino-1-hydroxybenzene-4-sulphonic acid with 2:5-dimethoxyaniline, and 1-hydroxy-2-diazo-4-nitrobenzene with *m*-anisidine. The products may be after-treated with oxidising and with metal-yielding agents. Alternatively, copper compounds of the aminoazo dyes may be used in the condensation. The copper complex compounds give brown, olive and orange shades on cellulose fibres. C.

**Pelts or Furs: Setting Hair.** S. Gottfried (to Pannonia (London) Ltd.). U.S.P.2,323,751 of 6/7/1943 (through *Chem. Abs.*, 1944, 38, 278). The hair is treated with formaldehyde vapour and, while some aldehyde remains on the hair, it is subjected to the simultaneous action of mechanical pressure and heat to cause setting. W.

**Peroxide Bleach Liquor: Stabilization.** E. I. Du Pont de Nemours & Co. U.S.P.2,333,916. A solution of a per-compound at pH 11.5 (or more alkaline), containing an alkali pyrophosphate, is stabilized by means of a magnesium salt. C.

**Polyamide Coating Composition: Application.** E. I. Du Pont de Nemours & Co. U.S.P.2,333,917. Fabric is given a base coating of a synthetic linear inter-polyamide and then coated with a reaction product of an organic poly-isocyanate with a linear poly-ester-amide in which 50-95 per cent. of the ester+amide groups are ester groups. C.

**Continuous Peroxide Bleach.** E. I. Du Pont de Nemours & Co. U.S.P.2,334,066. The claim is for a process in which the cloth is impregnated with an alkaline solution of a per-compound, rapidly heated to 200-212°F. by passage in contact with steam, and stored out of contact with the main body of the liquor or steam under such conditions that heat losses are reduced, but no further heat input occurs for at least 30 minutes. C.

**Cloth Coating Machine Doctor Rod.** Dow Chemical Co. U.S.P.2,334,102. Apparatus for coating flexible sheet material is fitted with a smooth rotatable doctor rod, not more than  $\frac{1}{8}$ -in. thick, supported rigidly, and heated. C.

**Alkyd Resin Finishing Emulsion.** American Cyanamid Co. U.S.P.2,334,107. An emulsion for imparting a full, crisp handle to textile fabrics contains 30-60 per cent. of an alkyd resin having an acid number not more than about 27.5, e.g. ethylene or propylene glycol phthalate. C.

**Sliver Dyeing Package: Winding.** Abbott Machine Co. U.S.P.2,334,165. Sliver is cross-wound on a frictionally-rotated perforated barrel, the pitch of traverse being progressively decreased to compensate for the increase of weight so that the tension in the sliver is equalized. C.

**Dye and Resin Emulsion: Padding.** Copeman Laboratories Co. U.S.P.2,334,199. Textiles are padded with an emulsion containing an organic solvent, a resin and a dye, and then dried, so that the discrete fibres are bonded by a film of coloured resinous substance. C.

**Dichloroethylene Co-polymer Coating Composition.** E. I. Du Pont de Nemours & Co. U.S.P.2,334,236. Cellulosic material is coated with a co-polymer of unsymmetrical dichloroethylene (40-80 per cent.) and at least one different polymerizable compound containing the group XC:CH<sub>2</sub>, X being a negative group devoid of unsaturated C—C bonds. C.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Coloured Cottons: Characteristics.** *Cotton (M/cr.)*, 1944, 50, No. 2406, p. 5. United States Department of Agriculture laboratories have been developing white, brown, and green lint cottons. Brown lint occurs in every known species the intensity of the colour ranging from a very faint cream as in Pima-Egyptian, to a very dark brown, as in Nankeen, an Upland cotton. Green pigmented cotton occurs only in one species, American Upland. Green-lint strains have the highest wax content of all cottons. The possibility of combining, through hybridization and subsequent selection, this wax content with the lint colour



and other desirable characteristics of the commercial white lint strains is of interest. The pigment affecting the colouration of several brown-like strains is found in the lumen or protoplasmic debris of the cell, and the colour does not develop until the boll opens. The green pigment occurs in the cell wall; it may be seen soon after the fibres begin to thicken and is apparent by 25 days after flowering. As the fibres develop, the colour is intensified until the boll opens, displaying the bright green pigmentation. On exposure to light, the colour gradually fades to a brownish green. It is doubtful if these cottons will ever be grown commercially to supply fibre for making cloth which would not have to be dyed. They are characterised by very low yields and very low lint percentages. The brown lints are very short and weak, and fabrics made from them are very mottled because of the variation in intensity of the pigments. The green-lint fibres are 100 per cent. immature. They have, however, been made into yarn that is as strong as the yarn ordinarily obtained from longer cottons. The instability of the green pigmentation would prevent the commercial use of green fibres as a means of obtaining natural coloured fabrics. C.

**Degraded Fibres: Electron Microscope Investigations.** E. Husemann and A. Carnap. *J. makromol. Chem.*, 1943, 1, 16-27 (through *Chem. Abstr.*, 1944, 38, 1107<sup>9</sup>). A preliminary report is given of the appearance under the electron microscope of cotton, beech pulp, various rayons, wool, silk and polyamide fibres which had been heated at 60° with 2N. hydrochloric acid or 0.5M. K bisulphate for times from 1 hour to 116 days. The oblong fragments appeared as fibrils; the finest of these were from the native cellulose and had a diameter of about 60 Å., whereas the fibres from the other materials were considerably thicker and showed less tendency to split into finer fibrils. C.

**Dyed Pulp Fibres: Dichroism.** P. R. Wiley. *Amer. Dyes. Rept.*, 1944, 33, 95-98, 110-116. The dichroism of dyed cellulose fibres is generally considered to be due to an orientated adsorption of dye particles possessing intrinsic dichroism on an orientated cellulose structure. A brief historical review of the phenomenon is given. A photo-electric instrument is described which has been designed for the measurement of the transmittances of dyed pulp fibres for light polarized at any desired angle with the fibre axis. The validity of choosing a relation between the transmittances obtained for the two cases where the plane of polarization is parallel and perpendicular to the fibre axis as a means of expressing the degree of dichroism of the fibre is demonstrated. The relation selected is the ratio of absorption coefficients for parallel and perpendicular polarization for a given wave length and depth of dyeing. Using the above mentioned instrument and relation, a study has been made of the factors affecting the dichroism of dyed pulp fibres and hence of the extent to which a dye is oriented on the fibres. The results show that the dichroism increased with decreasing amounts of lignin in the pulp. Short-fibred fractions of pulp exhibited less dichroism than long-fibred fractions. Treatment with chemical swelling agents decreased and beating increased the dichroism of the pulp. Dichroism increased with addition of salt to the dyebath and with increase in the concentration of the dye in the bath. Variation of the temperature of the dyebath appeared to have no appreciable effect. An attempt is made to explain these effects and show their significance. C.

**Fibres: Interference Colours in the Polarization Microscope.** A. Herzog. *Kleppig's Textil-Z.*, 1943, 46, 171-177 (through *Chem. Zentr.*, 1943, i, 2654 and *Chem. Abstr.*, 1944, 38, 1118<sup>9</sup>). The most important interference colours of several natural fibres, interference colours in daylight, and addition and subtraction colours obtained by the use of Gypsum Plate Red I are discussed and a diagnostic scheme is developed. The dichroism of many fibres after dyeing or incorporation of colloidal metals or non-metals is discussed. C.

**Cellulose Fibres: Heat of Water Sorption.** K. Lauer, R. Döderlein, C. Jäckel and O. Wilde. *J. makromol. Chem.*, 1943, 1, 76-96 (through *Chem. Abstr.*, 1944, 38, 1354<sup>9</sup>). The heat of adsorption was determined for a number of pulps (including spruce, pine, cereal straws and other plants), viscose rayon and staple fibres from various woods, straws, etc., and ramie, cotton and filter paper. Ramie, cotton, and filter paper (and certain pulps) gave an average value of 1.69 ( $\pm 5$  per cent.) kg.-cal./mole  $C_6H_{10}O_5$ , pulps gave a value of 2.11 ( $\pm 10$  per cent.), and viscose rayon and staple fibres gave 3.41 ( $\pm 8$  per cent.).

After extracting the pulps with aqueous caustic soda (removal of hemicelluloses), the heats of adsorption were the same as for ramie, cotton and filter paper. The extracted hemicelluloses gave a value of 4.8 kg.-cal./mole  $C_6H_{10}O_5$ . The heat of adsorption ("heat of solvation") for regenerated cellulose was thus twice that of native cellulose. Calculated for 1 mole of water, the heat of adsorption was 3.40 kg.-cal. for both types of fibres. This value is very nearly that of the heat of hydration (per mole of water) liberated on the formation of solid sugar hydrates from crystalline  $\beta$ -sugars and liquid water and that of the heat of mixing of ethyl alcohol with water. This agreement is in favour of hydrate formation between cellulose and water. This is discussed in terms of the intermicellar distances. The heat of adsorption of mercerised celluloses increased with the time of mercerisation with 20 per cent. caustic soda at 20° (the degree of polymerisation was practically unchanged); this increase is explained by an increase in the amorphous portion. Degradation with acids or treatment in an oscillating mill did not change the heats of adsorption of rayon, ramie and wood pulps; likewise, heating in glycol caused no change. In spite of their greater internal surface, the heat of adsorption of isotropic fibres (i.e. showing no elongation) was not higher than that for regenerated fibres (2.38-2.66 as compared with 3.41); fibres prepared by spinning into 60-65 per cent. sulphuric acid have values of 3.08 and 3.40.

**Cellulose Fibres: Wet Strength and Elongation.** (1) K. Lauer. (2) W. Mansch and K. Lauer. *J. makromol. Chem.*, 1943, 1, 97-105, 106-112 (through *Chem. Abstr.*, 1944, 38, 1355<sup>4</sup>). (1) Differences in the wet strength of natural and regenerated cellulose fibres may be a result of chain length, crystal lattice arrangement or fibrous structure (e.g. spiral and vertical orientation of the fibre elements). The relative wet strength of American and Egyptian cottons and ramie which had been mercerised with and without stretching were determined to 100.25 per cent. of the dry strength (i.e. values close to those for unmercerised fibres); also for cotton degraded with aqueous hydrochloric acid for 6 hours at 55° and that mercerised prior to degradation. The fact that the relative wet strength of the last two was nearly the same (about 100 per cent.) indicates that the value is not influenced by the crystal lattice arrangement or the chain length. The wet strengths for viscose rayon fibres before and after reversion to the native form (heating with ethylene glycol and tetrahydrofurfuryl alcohol) were 52-7.5 per cent.; this indicates that polymorphism is not responsible for the wet strength. The absolute breaking length of rayon fibres increased with increasing degree of stretching, but the relative wet strength remained practically unchanged. No relation could be established between the degree of orientation and the magnitude of the relative wet strength. It is concluded that it is impossible to increase the relative wet strength of regenerated cellulose fibres to any extent merely by stretching. For regenerated fibres the breaking length did not decrease until the moisture content was above the adsorption limit, whereas for cotton the value increased with increasing moisture content within the adsorption range and then became constant. (2) A theoretical treatment of investigation of the elongation process by means of tension-elongation curves.

**Cotton Fibre: Variation of Length in Bulk and on a Single Seed.** R. L. N. Iyengar. *Indian Textile J.*, 1944, 54, 197-199. The author took half a pound of seed cotton from a bulk sample, selected by a suitable sampling technique ten seeds, passed each seed through a hand gin and weighed each yield of lint, and then ginned the remainder of the half-pound. The lint from each individual seed and two tufts of lint from the main supply were then examined by means of the stapling apparatus of Ahmad and Nanjundayya with the attachment for obtaining the fibre length distribution (1938). The test was applied to Sind Sudhar, Jayawant, Surat 1027 A.L.F., and Punjab-American 4F cottons. A table records the weight of lint put through the stapling test, the mean fibre length, the standard deviation and the coefficient of variation (C.V.). The values of C.V. are all in the neighbourhood of 20 per cent. and the values for individual seeds are not really lower than those for the bulk. This suggests that because the variation on a single seed is so large the relatively smaller variations between seeds, bolls, plants, etc., that are added in the bulk samples are without much influence on the total variation.

**Cotton and Rayon Fibres: X-Ray Diagrams.** I. Fankuchen and H. Mark. *Record Chem. Progress*, 1943, 4, 54-57 (through *Chem. Abstr.*, 1944, 38, 1357<sup>3</sup>). New experiments are reported on monochromatic diagrams of the cellulose fibre, and on X-ray diagrams of single fibres in search of information concerning the nature of viscose, acetate, nylon, Saran and other artificial filaments. C.

**Electron Microscope: Construction and Application.** H. Hunter. *Textile Weekly*, 1944, 33, 782-8. A popular account of the theory of the use of electron beams for "seeing" objects too small for the optical microscope, a brief description of the electron microscope (Radio Corporation of America), and suggestions for its use in textile research. C.

**Linear Polyamide Fibres: Structures and Properties; Effect of N-methylation.** W. O. Baker and C. S. Fuller. *Ann. N.Y. Acad. Sci.*, 1943, 44, 329-349 (through *Phys. Abstr.*, 1944, 47 A, 42-43). A series of nine N-methylated polyamides, with methyl substitution varying in polydecamethylene sebacamide from 0 to 55 mol. per cent., was studied. Young's modulus, moisture sorption and relative solubility were chosen as properties representing the gross solids, whilst the corresponding fine structure was studied by X-ray diffraction from oriented and unoriented sections. The elastic modulus and hardness decrease with increasing N-methylation, relative solubility increases and moisture sorption increases. The interchain spacings are not changed by the methyl substitution, but at higher amounts of substitution one of the principal spacings (3.76 Å.) becomes diffuse. The chains appear retracted by partial folding along the fibre axis. C.

**The Wyoming System for Scoring Corriedale Sheep.** F. S. Hultz. *University of Wyoming: Agric. Exper. Sta., Bull.* No. 258, 1943. A scoring system used in connection with the experimental breeding of Corriedales consists of the use of graphic charts with line symbols for describing the conformation of the sheep, and of standard photographs in three poses against a checkered background. The results of the body analyses are discussed. The wool analyses are based on a fleece score which places 80 per cent. of emphasis on the clean wool produced, 10 per cent. on the variability of fibre diameter and 10 per cent. on type of crimp. The fleece score for each sheep is computed from the formula:

$$\text{fleece score} = 8 \frac{(\text{wool weight value} + \text{variability value} + \text{crimp value})}{10}$$

A set of standards of crimp type is presented, the designations suggested being bold, distinct, intermediate and dim. W.

**Proposed Methods of Test for Estimating the Clean Wool Content in Wool in the Grease.** Amer. Soc. for Testing Materials, Committee D-13. *A.S.T.M. Standards on Textile Materials*, 1943, 385-389. The following methods are proposed for determining the clean wool contents of different types of raw wool: (1) scouring, carding and combing, (2) scouring and determining vegetable matter on a laboratory scale, (3) scouring and carbonising (all wool found in wastes to be included), (4) scouring, drying and testing, then carbonising and adding average correction for wool lost. The method is also applicable to mohair, alpaca, camel hair, cashmere and vicuna. W.

**Standard Method of Test for Hard Scoured Wool in Wool in the Grease. D 584, 1943.** Amer. Soc. for Testing Materials, Committee D-13. *A.S.T.M. Standards on Textile Materials*, 1943, 281-284. Hard scoured wool shall be wool having a regain of 13.6 per cent. (equivalent to 12 per cent. moisture content), a combined ether and alcohol extractable matter content of 1.5 per cent. and an ash content of 0.5 per cent. Laboratory test methods are given for scouring and drying samples of opened wool, for determining ether and alcohol extractable matter and ash, and for calculating the percentage of hard scoured wool as defined above. W.

#### (B)—YARNS

**Strength Testing Machine.** L. Gillemot. *Technika* (Budapest), 1942, 23, 385-393 (through *Chem. Zentr.*, 1943, ii, 1162-1163 and *Chem. Abstr.*, 1944, 38, 1110<sup>9</sup>). The theoretical basis and a description are given of a tensile strength testing machine for paper, leather and textile investigations which has a range of 200-400 and 40-1000 kg. The error is 0.1-0.2 per cent. C.

**Cambridge Textile Extensometer.** Cambridge Instrument Co. *Textile Manufacturer*, 1944, 70, 171, 179. An illustrated description is given of an instrument for making the load/extension diagram of fibres or yarns, at constant rate of loading or constant rate of extension. The specimen and a spring are simultaneously extended by independent means, a constant speed motor being normally used for the spring and a second motor for the specimen. This motor is switched on and off by a sensitive device that keeps the tensions equal in the specimen and spring. C.

**Textile Testing Machines: Reduction of Vibration.** R. W. Vose. *Textile Research*, 1944, 14, 76-79. A critical study of a Scott pendulum type tensile tester, a Saco-Lowell sliver tester, and a Belger roving tester revealed the outstanding defects in all the machines to be considerable inertia and a tendency towards vibration, which severely limited the operating speed. To improve the sliver tester, the weights were hung on springs, the lever system was reconstructed from light metals and with very light sections at all points, and the tracing pen was also lightened. The speed of the machine was increased to approximately seven times its original value by providing new gears, and a small rubber bushing was inserted in one of the links of the recording mechanism to eliminate a slight vibration from the gears. Changes in the chart drive made it possible to condense the record from an entire can of sliver into a chart not over a yard long. In the roving tester a spring was substituted for the gravity pendulum with changeable weights and it was found possible to increase the speed by about five or six times. An entire 1.4 lb. bobbin of 1.65-hank roving could be tested in about 20 min. Changes in the chart speed were made to condense the record and rolls of adding machine paper were substituted for the original printed chart. Cyclic errors of considerable magnitude between the actual load and the indication of the machine were observed with the pendulum-type tensile tester. It was also noticed that the inertia of the pendulum comes into play after the fracture of the specimen so that the machine overshoots the actual load at fracture. This machine is unsatisfactory for use on new materials of high elasticity or others with unusual properties. C.

**"Grex" Yarn Counts System.** A. G. Scroggie. *Rayon Textile Monthly*, 1944, 25, 17-19, 69-71, 121-122; *Textile World*, 1944, 94, No. 1, 84-85; *Cotton (U.S.)*, 1944, 108, No. 1, 71-74; No. 2, 99-101; *Textile Manufacturer*, 1944, 70, 180-183. W. H. Slater. *Textile Weekly*, 1944, 33, 632-6. The proposed "grams per 10,000 metres" system of yarn counts is explained and arguments are advanced for its general adoption. C.

**Rayon Yarn: Testing and Quality Control.** C. W. Bendigo. *Textile World*, 1944, 94, No. 3, 86-87. A brief review of routine tests for quality control in rayon thread production with special reference to (1) twist testing, (2) stroboscopic check of spindle speed, (3) load/extension tests on the inclined plane machine, (4) uptake of soaking solution, and (5) density of package. C.

**Cuprammonium Dispersions of Cotton and Rayon Fabric: Flow Characteristics.** Viola C. Jelinck. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 172-178. The flow characteristics of cotton and regenerated cellulose fabrics dispersed in cuprammonium solution were determined by means of flow/pressure and fluidity/velocity gradient graphs. Under the experimental conditions recommended by the American Society for Testing Materials, 0.5 per cent. cotton-cuprammonium dispersions with fluidity values ( $F_c$  corrected for kinetic energy) greater than 19 rhes and 2 per cent. regenerated cellulose dispersions are simple liquids; 0.5 per cent. cotton-cuprammonium dispersions with  $F_c$  values less than 17 rhes are complex liquids rather than plastic materials, since they do not exhibit a real yield value. The equation  $F_0 = C'/t$  may be used for the calculation of fluidity values less than 7 rhes, since the kinetic energy correction for these values is negligible. Either the Poiseuille equation or the equation  $F_c = C'/(t - K/t)$ , more frequently used in calculating the fluidity of cellulose dispersions, is suitable for calculating fluidity values greater than 7 rhes. The velocity gradient adjustment is applicable to the complex cotton-cuprammonium dispersions with  $F_c$  values less than 10 rhes. The equation  $F_0 = q/C(P - p)$ , intended for plastic materials, should not be used for calculating the fluidities of cellulose fabrics since they form either simple or complex rather than plastic dispersions, and they often require the kinetic energy correction. ( $F_0$  is Bing-

ham's mobility value which is not corrected for kinetic energy,  $q$  is the rate of flow in millilitres per second,  $C$  is the instrument constant,  $P$  the hydrostatic pressure and  $p$  the yield value,  $C' = C/d$  where  $d$  is the density of the cuprammonium solvent,  $t$  is time of flow in seconds, and  $K$  is the kinetic energy correction constant). Either the burette consistometer or the viscometer may be used for regenerated cellulose dispersions or cotton dispersions with  $F_c$  values greater than 10 rhes. The burette type of capillary instrument has an advantage over the single-volume viscometer type for the determination of the fluidity of complex cotton-cuprammonium dispersions with  $F_c$  values less than 10 rhes, since the velocity gradient adjustment is readily obtained with the burette consistometer in one discharge. C.

#### (C)—FABRICS

**Aeroplane Fabric Punch Tester.** *Engineer*, 1944, 177, 347. A practical method of testing aeroplane fabric for strength has been made possible by the development of an automatic mechanical tester by the United States Civil Aeronautics Administration. The device operates similarly to a spring centre punch. When the disc-like pad is placed against the fabric and the handle pressed down, a centre plunger is driven through the pad and against the fabric with a known force. The tester can be used on a fabric anywhere about an aeroplane, eliminating the need of cutting out pieces. The internal spring is adjusted to various grades of fabric. The plunger makes a slight dimple in the finish of fresh, live fabric, and the mark soon disappears. Tendered fabric, even though stretched taut by a fresh coat of dope, gives way before the plunger, which either makes a clean hole or produces permanent cracks in the finish. C.

**"Crown" Tested Rayon Fabrics: Quality Control.** A. R. Wachter. *Amer. Dyes. Rept.*, 1944, 33, 100-105. The Quality Control Plan introduced by the American Viscose Corporation in 1930 and applied first to knitted rayon underwear and then to woven fabrics is briefly discussed and an account is given of the "Crown" Tested Plan introduced by this company in 1942. Under this plan, fabrics by licensees of the American Viscose Corporation, containing the company's "Crown" Rayon may be submitted for fabric stability tests, including fabric strength, seam slippage, dimensional restorability, colour fastness, permanence of finish and other qualities. Minimum Test Requirements have been established for rayon fabrics for men's wear, women's wear and home furnishings, special attention being paid to the particular use to which the fabric will be put. Samples of every colour of every dye lot are tested. Fabrics which pass the tests become eligible to carry identification as "Crown" Tested, which will be indicated to the consumer by the presence of a "Crown" Tested tag or label. Every effort has been made to make the "Crown" Tested tags or labels truly informative and helpful to retailers and customers. Each Minimum Requirement specifies the tests which the fabric must meet to carry identification as "Crown" Tested. The nature of some of these tests is indicated. C.

**Dyed and Printed Cotton Fabrics: Fastness to Washing.** G. A. Moran. *Amer. Dyes. Rept.*, 1944, 33, 105-106. The effects of friction or rubbing on dyed or printed cotton materials and differences in the behaviour of vat and naphthol dyes and pigments in standard tests for fastness to washing and on laundering are discussed. A friction, rub or abrasion test is suggested, which will indicate the effects of subjecting the material to energetic friction or rubbing action with soap and water. A modified crockmeter is used for this test. The sample, wet out in standard soap solution, is so attached to the moving arm of the crockmeter that it will rub upon itself as many strokes as found suitable. An appreciable removal of colour will occur with "loose" colours. C.

**Fabrics: Strength Testing.** *Textile World*, 1944, 94, No. 2, 146. The writer suggests the need for experiment on and standardisation of the method of tightening the grips in cloth strength tests. Stress/strain curves are reproduced for specimens with (1) the grips tightened at the outset, (2) the grips tightened on reaching the critical point (a load of 400 lb.), (3) the grips gradually tightened during the test. No. 1 gave a smooth curve, (2) gave a more erratic curve until the grips were tightened, and a higher break, and (3) was still more erratic and gave the highest break. Method (2) is preferred by the writer. C.

**Rayon Stockings: Wearing Qualities.** Hazel M. Fletcher. *Rayon Textile Monthly*, 1944, 25, 86-87, 136-138. A series of tables record the data collected in a study of the wearing qualities of viscose, cuprammonium and acetate rayon stockings, worn by 15 people. Table I gives the type of reinforcement, price, shrinkage in the wash, yarn count and filament denier, and knitted construction; II-V, the bursting pressure at various parts, for new and worn stockings, with the analyses of variance; and VI-VIII, the hours of wear, number of launderings, and fading indexes, with analyses of variance. A set of load/extension diagrams of the yarns is also provided. The acetate rayon hose kept their shape and colour and fitted better than the others but wore into holes more readily. The three types were alike in bursting strength when new, but the viscose stockings wore on an average for 330.6 hours, the cuprammonium for 311.1 hours, and the acetate for 194.2 hours. C.

**Sized Cotton Cloth: Size Content Determination.** *Indian Textile J.*, 1944, 54, 192. Details are given of two methods for the determination of size content under the Indian Starch Control Order, 1943, with a list of nine laboratories authorised to perform the analysis. In the first method, size is removed by boiling the specimen in soap and soda. The second method consists of extraction with carbon tetrachloride followed by digestion with diastase. C.

**Proposed Method for the Quantitative Analysis of Textiles Composed of Wool and Lanital.** Amer. Soc. for Testing Materials, Committee D-13. *A.S.T.M. Standards on Textile Materials*, 1943, 383-384. A proposed flotation method is described for preparing the test specimen of yarn and the separating liquid, for making the actual separation and for calculating the lanital and wool contents of the cloth. W.

#### (D)—OTHER MATERIALS

**Elastensometer.** G. D. Kish. *Rubber Age*, 1943, 53, 131 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, 245). In the Elastensometer, an instrument for testing the elasticity of rubbers at low temperatures, the specimen, in the form of a simple beam, is supported over anvils and centrally loaded. The force required to produce a given constant deflection is transmitted through a spring and indicated on a scale. The base of the instrument is immersed in a cup of alcohol and the temperature is lowered by the addition of "dry ice." Results are reported in the form of temperature-load curves. Curves are shown for a typical safe low temperature material and a material whose critical temperature is above 0° F. The modulus of elasticity is obtained by the use of the conventional beam deflection formula. A diagrammatic illustration is given of the changing values of the modulus of elasticity of rubber-like material with decreasing temperature. Since the modulus of elasticity in bending tends to increase as the temperature is lowered, the limiting critical temperature as obtained with the Elastensometer may be defined as that temperature where the normal value for the modulus increases to the maximum value permitted for the application. Critical values are tabulated for a typical material. C.

**Elastomers: Tensiometer Stiffness Test.** B. K. Green, R. G. Chollar and G. J. Wilson. *Rubber Age*, 1943, 53, 319 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, 245 and B1.2: 145). Details are given of a tensiometer stiffness test for elastomers at low temperatures in which a Cenco du Nouy Precision Tensiometer, No. 10,402, is used. Young's modulus can be calculated from the tensiometer readings. The application of the test to Hycar OR samples is reported. Temperature/stiffness curves and data showing the variation of stiffness with thickness are presented. C.

**Plastic Sheets and Films: Gas Transmission.** H. R. Todd. *Paper Trade J.*, 1944, 118, TAPPI, 84-87. A simple volumetric apparatus for measuring the transmission of gases through sheets and films is described. The sheet separates a chamber of volume about 10 c.c. from one of about 500 c.c. The larger chamber is evacuated, whilst the smaller chamber is maintained at atmospheric pressure. The consequent movement of gas through the sheet, results in the movement of a column of liquid in a horizontal capillary tube to displace the gas transmitted from the small chamber. The volume of gas transmitted is thus measured directly. The sensitivity of the apparatus is approximately 0.019 c.c. per 100 sq. in. per 24 hours for a 24-hour period. Tests with ethyl-

temperature sometimes have very low brittle-point temperatures. The latter are therefore inadequate for use as indices of low-temperature serviceability. It is pointed out that although natural rubber is basically more cold resistant than some of the synthetic elastomers it is possible to compound synthetic elastomer stocks having better low-temperature properties than natural rubber stocks. C.

**Cellulose Bacteria: Activity.** W. H. Fuller and A. G. Norman. *J. Bacteriology*, 1943, 46, 273-289, 291-297 (through *Chem. Abstr.*, 1944, 38, 2017). Five new species of aerobic cellulose-decomposing organisms are described: *Pseudomonas ephemerozyanea*, *P. lasia*, *P. erythra*, *Achromobacter picrum* and *Bacillus aporrhoeus*. With the exception of *P. erythra* all are capable of growing well on many carbohydrates. *A. picrum* alone produces acid from cellulose and sugars. The more active of the organisms used about one-third of the filter paper supplied in 14 days. Cornstalk cellulose was far more extensively used by all of the organisms in an equal time. The presence of xylan in the cellulosan component of the cornstalk cellulose exerted a favourable influence on decomposition. About 75 per cent. of the xylan was more readily available than the remaining fourth. Cornstalk cellulose with the major part of the xylan removed resembled filter paper in availability. There is some evidence that a portion of the xylan may be present in imperfect cellulose chains. A series of preparations with decreasing lignin content was obtained from jute fibre by treatments with monoethanolamine. The extent of cellulose decomposition produced by the vigorous organisms, *Ps. ephemerozyanea* and *Sporocytophaga myxococoides*, increased as the lignin content decreased. Less vigorous organisms were little affected by the lignin content of the substrate. Both used the xylan component of the cellulose disproportionately. Both lignin and cellulose in the cell wall form interpenetrating systems; the effects of lignin in reducing the availability of cellulose are probably physical. C.

**Termite Protozoa: Digestion of Cellulose.** R. E. Hungate. *Ann. Entomol. Soc. America*, 1943, 36, 730-739 (through *Chem. Abstr.*, 1944, 38, 794<sup>9</sup>). Cellulose-digesting protozoa (the hypermastigote flagellates *Trichonympha colaris*, *T. campanula*, *T. sphaerica* and the polymastigote flagellate *Trichomonas termopsidis*) were removed from the alimentary tracts of termites (*Zoötermopsis nevadensis*, *Z. angusticollis*), suspended in an inorganic salt solution and allowed to act on powdered cellulose for periods up to 108 hours at 25.5°. The digestion products, which were recovered to 70-75 per cent. of the initial cellulose, consisted of carbon dioxide, hydrogen and acids, principally acetic acid (85 per cent. of total acid). No glucose was demonstrated as a product of cellulose digestion by the protozoa. Apparently, the principal carbonaceous materials used by *Zoötermopsis* are fermentation products produced by protozoa from the glucose which they obtain by cellulose digestion. Gas and acid (acetic acid, etc.) were identified as products of cellulose digestion by protozoa taken from the digestive tracts of another termite (*Reticulitermes flavipes*). Probably an anaerobic fermentation process is characteristic of most of the wood-digesting protozoa found in termites. Tests showed that acetic acid and probably also the non-volatile acids produced by the protozoa are absorbed from the mid-intestine of the termites. These acids are oxidised by the termites to obtain energy; carbon, carbon dioxide and hydrogen are eliminated. C.

**Proteolytic Enzymes: Activity Measurement; Gelatin Viscosity Reduction Method.** F. G. Lennox. *J. Council Sci. Ind. Res. (Australia)*, 1943, 16, 155-166 (through *Chem. Abstr.*, 1944, 38, 758<sup>9</sup>). The gelatinase activities of trypsin, papain, euphorbain and a mould protease were measured by means of the digestion flask viscometer. The time for a given change in viscosity bears no constant relation of concentration over a wide range of enzyme concentrations. Although the relation between viscosity after 10 min. at 40° and enzyme concentration always approximates to a hyperbolic form, the shapes of the curves for different enzymes and for different samples of the same enzyme diverge appreciably at high concentrations. Thus the activity cannot be expressed in terms of equivalent enzyme concentration by reference to a simple equation or calibration curve, and it is reported as reduction in viscosity of the enzyme-gelatin mixture after 10 min. at 40°, expressed as a fraction of the initial viscosity. Determination of the amino and carboxyl groups in



enzyme-gelatin mixtures shows that chemical splitting can be detected within 1-2 min. of adding the enzyme. After 8 min. at 40° certain highly active enzyme solutions have reduced the viscosity almost to a minimum value, and at this point approximately three peptide bonds are split per 10,000 g. of gelatin. If a molecular weight of 35,000 is assumed for gelatin, the average molecular weight of the resultant polypeptides would be approximately 2,800, which corresponds to chains of about 28 amino acid residues. C.

**Cellulose: Heterogeneous Degradation.** O. Eisenhut and E. Schwartz. *Die Chemie*, 1942, 55, 380-387 (through *Chem. Abstr.*, 1944, 38, 249'). Measurements of the changes in the degree of polymerisation show that the heterogeneous hydrolytic degradation does not proceed according to a zero-order reaction, as a slowing down with time occurs. The initial velocity of hydrolysis of various fibre types in ascending order is: native untreated fibre, native mercerised fibre and regenerated cellulose fibre. For all regenerated cellulose fibres the  $k$ -values of the zero-order reaction equation became equal after relatively short time of hydrolysis. Even with prolonged periods of hydrolysis, the  $k$ -values of the untreated cotton remained appreciably lower and those of mercerised cotton definitely lower than the values for the fibres from regenerated cellulose. The velocity of the hydrolytic degradation as a function of temperature and concentration was determined. The effect of caustic soda pretreatment upon the velocity of hydrolytic degradation and the solubility at various alkali concentrations was observed. The behaviour of sulphite pulp was also observed and an explanation presented for the initial deviation compared with the behaviour of cotton. Observations of the changes of the  $k$ -values and the X-ray structures of crude and alkali-treated cotton fibres are discussed. The slowing down of the degradation reaction in the course of hydrolysis is explained on the basis of localised attack areas where the acid attack leads to the rapid formation of very short cellulose chains which then greatly limit the further acid attack. Intermittent alkali treatments remove these chains and permit renewed acid attack. The relationship between breaking strength and degree of degradation was investigated; the decrease of the breaking strength is proportional to the time of exposure to the degrading substances and is independent of the alkali pretreatment of the fibre. The decrease of the degree of polymerisation, however, is accelerated by alkali pretreatment. The relationship between degradation velocity and alkali solubility of hydrolytically as well as alkali degraded cotton fibre was determined. C.

**Cellulose Molecules: Form and Mobility.** P. H. Hermans, J. de Booy and C. J. Maan. *Kolloid Z.*, 1943, 102, 169-180 (through *Chem. Abstr.*, 1944, 38, 248'). A new model of the cellulose molecule is developed on stereochemical considerations with the aid of known atomic distances, valence angles and effective radii of atoms. A space-angled position of the chain is required and rings of adjacent glucose groups cannot be quite parallel. The polarity of the chains must alternate and the chains in adjacent layers must be moved along the fibre axis by 3-4 Å. in relationship to each other. Rotation about the O bridge is assumed and there is a possibility of transition from the "chair" to the "trough" form. C.

**Methyl Linoleate: Chromatographic Purification.** C. E. Swift, W. G. Rose and G. S. Jamieson. *Oil & Soap*, 1943, 20, 249-250 (through *Chem. Abstr.*, 1944, 38, 655'). A column of alumina for chromatographic adsorption is prepared by alternately pouring alumina and light petroleum (36-60°) in small portions into a chromatograph tube (400 g. alumina adjusted to activity of IV in a tube 1½ in. diameter) with a glass rod for stirring. A portion, 4 g. methyl esters of cottonseed oil in 150 ml. of petroleum ether, is introduced and the chromatogram developed with 1400 ml. of light petroleum. By this procedure a fraction of iodine number 74.6 was obtained consisting of a mixture of methyl esters. The methyl linoleate was eluted by rapidly forcing 2.5 l. more of light petroleum through with pressure. From a total of 16 g. of methyl esters, iodine number 108, 5.2 g. of methyl linoleate having an iodine number of 159.5 were obtained. After further purification, this had the following constants: iodine number 170.4, thiocyanogen number 87.3,  $n_D^{25}$  1.4594. The product was 97.7 per cent. pure. C.



**Polyhydric Alcohol Fatty Acid Esters: Preparation, Properties and Uses.** H. A. Goldsmith. *Chemical Reviews*, 1943, 33, 257-349. The methods of preparation, physical and chemical properties, and industrial applications of the higher fatty acid esters of polyhydric alcohols and of polyhydroxy ethers are reviewed. The bibliography has 572 entries. C.

**Proteins: Reaction with Formaldehyde.** R. L. Wormell and M. A. G. Kaye. *Nature*, 1944, 153, 525. Animal and plant caseins can be deamidated by treatment with a solution of 1 per cent. caustic soda for 40 hours at 45° C. The desamido-casein, when hardened with formaldehyde under neutral conditions, combines with the same amount of formaldehyde as does the untreated casein. In the presence of salts, acids and formaldehyde, the neutral hardened deamidated material combines with no additional formaldehyde, whereas the untreated neutral hardened casein may increase its formaldehyde content by about 100 per cent. Partial deamination is also possible without the removal of amide nitrogen. The partially deaminated product combines with a reduced quantity of formaldehyde under neutral conditions. In contrast to this, the same partially deaminated product combines with a normal quantity of additional formaldehyde when treated with formaldehyde, salt and acid. When zein is hardened in a neutral solution it combines with only 0.4 per cent. of formaldehyde, but in the presence of salt and acid, the combined formaldehyde increases to 4.1 per cent. These figures are in keeping with the low amino and high amide contents of zein. The conclusion is drawn that, at or near the isoelectric point of the protein, formaldehyde combines with the amino groups mainly derived from lysine residues whereas under more acid conditions it combines with the amide groups attached to residues of glutamic and related acids. C.

**Osmotic Balance.** I. Jullander and T. Svedberg. *Nature*, 1944, 153, 523-524. An osmometer in which the liquid passing through the membrane is weighed can be used for osmotic pressures from a few cm. of water pressure to some hundredths of a cm. In an undamped analytical balance one of the scales is removed, and on the floor of the balance case is fixed a stand with an adjustable platform carrying a glass cylinder filled with solvent. The osmotic cell is constructed of aluminium and glass, the necessary cementings being made with litharge/glycerin. The lower part of the cell is conical with a basal diameter of 5 cm. At the apex is fixed a glass tube a few cm. long and 0.9 cm. inner diameter. The upper part of the glass tube has an aluminium collar, carrying a wire so that the cell can be hung on the balance arm. A semi-permeable membrane is attached to the base of the conical recipient by means of a threaded ring and a perforated membrane-support. The membrane itself acts as packing material against leakage. The osmotic cell and part of the glass tube are filled with solution and suspended on the balance in such a way that the cell dips into the solvent in the glass cylinder. By means of the adjustable platform the difference in level between the solution in the cell and the solvent in the glass cylinder can be varied. The balance is adjusted to neutral equilibrium. When the weight of the cell increases, the cell sinks until the buoyancy compensates the increased weight. Because of the minuteness of the displacements, the reading of the balance is magnified by means of a doubly reflected beam of light. Arrangements are provided for reducing evaporation losses and for eliminating electrostatic effects. The use of this device for measurements on nitrocellulose in butyl acetate is described. For a nitrocellulose made from American linters and having a nitrogen content of 12.28 per cent., the molecular weight (number-average) corresponding to the osmotic data is 148,000. C.

**Indian Green Earth: Base-exchanging Properties.** N. R. Damle, R. B. Forster and K. G. Kudva. *J. Indian Chem. Soc., Ind. Ed.*, 1943, 6, 30-39 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 9). Green earth (Caledon earth:  $\text{SiO}_2$  66.1,  $\text{Fe}_2\text{O}_3$  6.3,  $\text{Al}_2\text{O}_3$  15.9 per cent.) adsorbs the cations of basic dyes and organic bases (aniline and *p*-phenylenediamine) irreversibly in proportion to their equivalent weight, all sorption curves being similar and not obeying Freundlich's law. The degree of sorption is decreased by pre-treatment of green earth with acids, but is increased by treatment with calcium, zinc or sodium chloride or sodium hydroxide, and is independent of the pH of the sorbate. Acid dyes and lakes are not sorbed. Ignition of green earth at 400° reduces, and at 800° abolishes, its sorptive power. Replacement of calcium by sodium

ions in green earth occurs on treatment with excess of sodium chloride. With fuller's earth, the degree of sorption is increased on treatment with acids. C.

**Hydrogen Bond: Occurrence.** L. Hunter. *Chemistry and Industry*, 1944, 155-157. A discussion of the nature of the hydrogen bond and essentials for its operation, the prevalence of the hydrogen bond in common substances, the influence of the hydrogen bond on the physical behaviour of water, hydrogen-bond association and tautomerism, hydrogen bonds involving atoms of fluorine, oxygen, nitrogen and sulphur, and evidence pointing to hydrogen bonds involving carbon. C.

**Bauxite: Use as Drying Adsorbent.** W. A. La Lande, Jr., W. S. W. McCarter and J. B. Sanborn. *Ind. Eng. Chem.*, 1944, 36, 99-109. The activation of trihydrate bauxites at temperatures up to 1600° F. has been studied with particular reference to the production of a highly efficient drying adsorbent. Data are presented to show the relationship between activation temperature, residual volatile matter content, surface area, dry gas capacity (a measure of the amount of water vapour held by the adsorbent up to the point where it just permits water to appear in the gas passing from it), and equilibrium capacity (a measure of the total amount of water vapour which can be removed by an adsorbent from a fluid stream under constant conditions of relative humidity, temperature and pressure). The mechanism of the thermal decomposition of bauxite is discussed with reference to the results of differential thermal and X-ray diffraction analyses. The maximum dry gas capacity is attained by activation at 700-750° F. This treatment reduces the volatile matter content of the mineral from about 28-30 to 6-8 per cent. Under optimum activating and operating conditions bauxite will adsorb 11-16 per cent. by weight of water before any moisture is detectable in the effluent. Activated bauxite may be regenerated repeatedly by heating at 300-500° F. Various other factors which influence drying efficiency, such as mesh size, moisture content of gas, velocity through adsorbent, adsorbent temperature, shape of adsorbent bed, and presence of impurities, are discussed. Some results obtained in the drying of gases at atmospheric and high pressures and in the drying of liquids are briefly discussed. C.

**Fibre Molecules: Coiling in Flowing Solutions.** W. and H. Kuhn. *Helv. Chim. Acta*, 1943, 26, 1394-1465 (through *Chem. Abstr.*, 1944, 38, 673<sup>9</sup>). Equations are derived that relate the amount of streaming birefringence or the direction of maximum refraction in flowing solutions of linear polymers to the degree of polymerisation (DP). The amount of streaming birefringence at limiting conditions is directly proportional to the DP and the direction at limiting conditions is proportional to (DP)<sup>2</sup>. Values for the DP calculated from these optical measurements agree excellently with values obtained from viscosity measurements (Staudinger). Data for DP determined with the ultracentrifuge are used for comparison. The agreement with data from viscosity or optical measurements is excellent, except when the DP is very high. It is suggested that this discrepancy exists because at high values the coiled molecules form a strongly felted structure which immobilizes solvent between parts of the network. The theoretical treatment used in deriving the equations referred to above is valid only when the surrounding liquid flows freely between the fibre molecules, as is the case when the DP is relatively low. C.

**Potato Starch Pastes: Viscosity.** P. E. Meiss, R. H. Treadway and L. T. Smith. *Ind. Eng. Chem.*, 1944, 36, 159-163. The influence of the conditions of preparation and measurement on the apparent viscosity or consistency of starch paste is discussed. The Brabender Viscograph is briefly described and an account is given of investigations made with this instrument. Although drying starch to nearly zero moisture content causes considerable lowering of paste consistency, the oven drying of wet starch to the air-dry moisture range, at temperatures below 90° C., does not result in such an effect. Consistency/temperature curves are given for two pastes made from the same starch, one using distilled water and the other using tap water. The lower consistency of the latter is attributed to soluble material in the tap water. The removal of soluble impurities from starch by washing is discussed and it is shown that the change in the consistency/temperature curve produced by washing gives indications of the causes of low consistency. The results of examinations of 24 samples of

potato starch produced in factories in the United States during the 1941-42 season are reported. It is pointed out that a sample of average-quality potato starch should have an ash content of about 0.35 per cent., low acidity, a  $pH$  near the neutrality point, high reflectance, and a paste consistency/temperature curve in which a peak occurs below the boiling point and which remains substantially unchanged when the sample is washed with distilled water. The influence of manufacturing methods and of the water used on the quality of starch is considered. Experiments indicated that the method of purification had no bearing on particle-size distribution. C.

**Starch and Bentonite Suspensions: Viscosity; Effect of Electrolytes.** A. v. Buzágh. *Kolloid Z.*, 1943, 103, 119-126 (through *Chem. Abstr.*, 1944, 38, 289<sup>9</sup>). The viscosities were measured at different concentrations and in the presence of various amounts of electrolytes such as Na, K, Ba, Cu, Al and Th chlorides, K and Mg sulphates, and K phosphate, ferricyanide and ferrocyanide. The results were compared with results obtained on quartz suspensions. In general, starch and quartz suspensions have similar properties, except that in starch both ions affect the viscosity, whereas in quartz only the cations have a pronounced effect. Bentonite suspensions, being hydrophilic, behave differently. C.

**Colour Harmony: Effect of Area.** P. Moon and Domina E. Spencer. *J. Optical Soc. America*, 1944, 34, 93-103. The scientific formulation of colour harmony is extended by taking into account the effect of area. It is found that a pleasing balance among colour patches is obtained when the scalar moments about the adaptation point in  $\omega$ -space are equal for all the patches. Other pleasing balances are obtained when the scalar moments of the various colour patches are simple multiples of each other. The balance point in  $\alpha$ -space of a system of colour patches gives a measure of the over-all colour effect of the design and, by choice of a proper balance point, the artist can emphasize a desired psychological effect. Moments in colour space are treated most simply by means of weighted points. The mathematics of this subject is developed, and the calculated areas for harmonious effects are tabulated for a large number of examples. Practical application of this system by the designer is briefly explained. C.

**Dyes and Pigments: Spectrophotometric Formulation.** R. H. Park and E. I. Stearns. *J. Optical Soc. America*, 1944, 34, 112-113. Methods are presented whereby the formulation of colorants needed to effect a visual colour match of a given standard may be computed from spectrophotometric measurements of the colorants and standard. C.

**Machinery Testing Devices.** Institution of Mechanical Engineers. *Engineer*, 1944, 177, 237-238, 257-258. Abstracts are given of papers presented at a symposium on modern aids in the investigation of materials, mechanisms and structures, including (1) electrical resistance wire strain gauges, (2) measurement of displacement and strain by capacity methods, (3) measurement of strain in components of complicated form by brittle lacquer coatings ("Stresscoat"), (4) high-speed cinematography, (5) temperature-indicating paints, and (6) study of internal stress in a metal by X-ray diffraction. C.

**Wool Wax Alcohols: Properties, Composition and Utilisation in Medicine.** E. S. Lower. *Mfg. Chem.*, Aug. and Sept., 1943. W.

**Thermally-shortened Keratin Fibres.** H. Zahn. *Naturwissenschaften*, 1943, 31, 137-139 (through *Chem. Abs.*, 1943, 37, 6285). Pure white horse hairs were heated by a Bunsen flame, shrunk 32 per cent., increased in thickness 58 per cent. and studied by X-ray. The diagram has 3 isotropic rings, 3.78, 4.60 and 10.1 Å, similar to that of the keratin decomposition product (*these Abs.* 1941, A601),  $d$ -keratin. Both materials are  $\beta$ -keratins. Measurement of swelling anisotropy shows the same change, only 2.9 for the heated hair, 16.4 for the original. During the heating process the weight loss is 2.6 per cent., the cystine content decreases 10 per cent., the isoelectric point changes little and the alkali solubility increases. The process is a "super-contraction" (Astbury and Woods, *these Abs.*, 1943, A60). Hairs will shrink in their own sorption moisture by rapid heating. The same effect is not found if water is absent. Heating in water at 130° for 2 hr. gives a 25 per cent. shrinking with formation of  $\beta$ -keratin, likewise heating at 150° in moist glycerol. W.

**Stretched and Super-contracted Human Hair: Microscopic and Hygroscopic Investigations.** T. Lochte and H. Brauckhoff. *Biochem. Z.*, 1942, 312, 41-59 (through *Chem. Abs.*, 1943, 37, 6290). The observations of Astbury and Woods (*these Abs.*, 1934, A60) on the extensibility of human hair were confirmed. It has been stated that red hair contains an unusual keratin, but no differences were observed between red and other hair, when subjected to humidity changes, under tension. Super-contracted hair is not as extensible in a normal atmosphere as the original hair. W.

**Sheep Maggots: Field Experiments on Control.** W. R. Angus, I. Thomas and O. G. Williams. *Ann. Appl. Biol.*, 1943, 30, 164-169 (through *Exp. Sta. Rec.*, 1944, 90, 233). In field experiments on about 4,700 sheep at about 40 different farms in N. Wales, crutching was the most effective control measure for lambs. Regular dipping with commercial arsenic-sulphur dips gave reasonable control except during adverse weather conditions. Dipping with zinc arsenite or with calomel proved, on the whole, less effective than dipping with commercial dip. An addition of calomel to commercial dip was more effective than commercial dip alone. Preliminary observations are given on the variation of the surface tension and viscosity of the dipping fluid as the number of sheep passing through the dip increased. W.

**British Sheep Blowflies: A Survey.** J. MacLeod. *Bull. Entomological Res.*, 1943, 34, 65-88, 95-111. W.

#### PATENTS

**Powder Specific Surface Determining Apparatus.** H. Heywood. B.P.560,037 of 10/9/1942:16/3/1944. Apparatus for examining suspensions comprises reflectors, mirrors, lenses and/or prisms operative for constraining separate beams of light from a common source to pass through respective test cells or spaces or through standard and test cells or spaces, respectively, and light-reflecting means for causing the beams issuing from the cells or spaces to be projected for comparison on to separate regions of an eyepiece, a graded light filter being movable in one of the beams to cause the intensities of the beams of light directed on to the eyepiece to be made equal to each other, and provision being made by which the amount of movement of the graded light filter may be used as a measure of the intensity of the light passing the cell or space under test. For the determination of the total specific surface or the particle size distribution, a suspension of the powder is placed in a test cell and a standard or comparison cell contains clear liquid of the same kind as that in which the powder is suspended. The graded light filter is suitably coupled with a pointer movable over a scale indicating optical densities. C.

**Carboxyethyl Cellulose Ether: Preparation.** Röhm & Haas Co. U.S.P. 2,332,048. A carboxyethyl ether of cellulose, soluble in water, is obtained by the treatment of cellulose at 5-35° C. with 10-40 per cent. alkali hydroxide and acrylonitrile in roughly equivalent proportions (based on the glucose unit). C.

**Cyanoethyl Cellulose Ether: Preparation.** Röhm & Haas Co. U.S.P. 2,332,049. A cyanoethyl cellulose ether, soluble in organic solvents, is obtained by treating cellulose at 0-30° C. with 10-30 per cent. alkali and 2-3 mol. proportions of acrylonitrile, based on the glucose unit. C.

**Alkali Metal Chlorites: Preparation.** Mathieson Alkali Works, Inc. U.S.P. 2,332,180, 2,332,181. (1) Chlorine dioxide is absorbed in an aqueous solution of an alkali metal bicarbonate containing hydrogen peroxide. (2) Chlorine dioxide is prepared by the reaction of a chlorate with mineral acid (*pH* not much above 1) and hydrogen peroxide at a temperature not much above 70° C. C.

#### 10—ECONOMICS

**Textile Wholesale Prices, March, 1944.** *Bd. Trade J.*, 1944, 150, 141. The wholesale price index numbers for March are Cotton 139·5, Wool 183·6, Other textiles 134·2 (1930=100). C.

**American Textile Industry: Future Prospects.** D. G. Woolf. *Textile Research*, 1944, 14, No. 1, 2-7. A discussion of the outlook in the textile industry, the certainty of a growth in research in the near future, research in connection with the war effort and its influence on the type of textiles available after the war, problems of the textile industry in the immediate post-war

period, new technical developments, textile raw materials of the future, the emergence of new finishes, the development of new equipment, and the economic outlook. C.

**Cotton, Yarn and Cloth: Controlled Prices, April, 1944.** W. H. Slater. *Textile Weekly*, 1944, 33, 584. New tables are provided with which to correct the author's previous lists so as to allow for the change in the Cotton Control basis from 7·80 to 12·75 d. per lb. for the price of American cotton. C.

**Indian Cotton Cloth: Production and Consumption.** M. Masani. *Indian Textile J.*, 1943, 54, 4-7. A popular account is given of the growth of the cotton industry in India with special emphasis on "clothing 400 millions." The following charts are noteworthy. (1) A map showing the concentration of the industry. (2) Graphs of numbers of operatives, mills, spindles and looms from 1879 to 1941. (3) Histograms of cloth consumption per head in India from 1915 to 1941. (4) Histograms of cloth consumption per head in 1936 for India and some other countries, Europe being represented only by Sweden and Ireland, and North America by Canada. C.

**Raw Cotton: Prices.** *Cotton (M/cr.)*, 1944, 49, No. 2403, 4; 50, No. 2404, 5. (1) Tables are given showing the controlled prices of American, Brazilian, African, Egyptian, Sudan and Peruvian raw cottons as from April 17th, 1944. (2) Official prices for various marks of Egyptian cotton are tabulated. C.

**Rayon: World Production and Consumption, 1942.** *Silk and Rayon*, 1944, 18, 263-264. The best available estimates of continuous filament and rayon staple production in 1942 are tabulated for 25 countries. The annual *per capitum* consumption of rayon, based on figures for 1937/9, is given as Germany 6·49 lb., Japan 5·30, Italy 3·82, Australia 3·08, United States 2·83, United Kingdom 2·44, New Zealand 2·43, Switzerland 1·97, Sweden 1·91, Canada 1·76, Czecho-Slovakia 1·73, Netherlands 1·36, Belgium 1·30, France 1·24, Denmark 1·14, Trinidad 1·04 and Eire 0·80 lb. The state of trade and post-war expansion are discussed. C.

**British Cotton Industry: Planning.** "*Times*" *Trade & Engineering*, 1944, 54, April, p. 42. The special committee appointed by the Cotton Board for dealing with post-war problems has asked the Government for an assurance that the appointment of a post-war Cotton Board will be made before the present Cotton Control is abolished. The certainty of a serious shortage of operatives in the industry after the war has directed special attention to the urgency of carrying out reforms which will make work in the mills more attractive. A committee of recruitment and training has already been appointed and a special department of the Cotton Board set up to administer the plans and policy of the committee. The intention is not only to ensure regular and interesting work at good wages, but also to offer good prospects of promotion to ambitious juveniles. The most recent development is the institution of a training scheme for foremanship and other mill executive positions and over 1,300 enrolments have been made for a course of 12 lectures. The total general wage advances for workers in the manufacturing section since the outbreak of war amount to 35 per cent. for cost of living, plus 9/- a week flat increase. It is expected that joint meetings will be held in the near future to discuss a starting-point system of wages for weavers. The sub-committee appointed by the Cotton Spinners' and Manufacturers' Association to investigate methods of wage payments and conditions of work in the weaving section has suggested a number of improvements which are likely to lead to higher efficiency and better relationships between employers and workpeople. A good response has recently been made to the request of the Cotton Controller for a resumption of overtime working in spinning mills. C.

**International Trade: Changing Outlook.** *Planning*, 1944, No. 219, 24 pp. A survey is made of pre-war trends in international trade and the economic effects of the war are discussed. The following conclusions are drawn:—(1) Exports are essentially a means of obtaining necessary or desirable imports, and should not be used primarily as a means of creating home employment. Both export and import policy should be deliberately related to a nation's Balance of Payments and its long-term foreign lending and borrowing. (2) Trade restrictions

and bilateralism were a symptom, more than a cause, of the decline in world trade after 1929. Post-war policy should aim at a continuing expansion of effective world demand, making full use of the world's man-power and resources. (3) Multilateral trade, whilst creating the necessary conditions for obtaining the greatest possible advantages from international trade, also heightens the economic interdependence of nations. A restoration of multilateral trade requires (a) an efficient international monetary exchange clearing system in which all nations have complete confidence, (b) the maintenance of full employment within national economies, and (c) the maximum attainable measure of political security. (4) Failing the establishment of a universal multilateral system of trade, the "low-tariff club" represents a means by which nations most dependent on international trade can secure the benefits of multilateralism on a limited scale. (5) "Lend-Lease" is essentially a war-time method of international exchange, and is unlikely to continue after the immediate post-war period of scarcities. International trade, however, must have a monetary exchange clearing system that is at once more flexible than the Gold Standard and more stable than freely fluctuating exchanges. (6) World prosperity, like peace, is indivisible. (7) Great Britain's major problem in the field of foreign trade after the war is to increase its visible exports very considerably in order to repair the inroads which the war has made into its invisible exports and overseas investment income and to maintain the volume of imports vital to its standard of living. The form of policy appropriate will inevitably be affected by the economic policies adopted by the rest of the world, and in particular by those countries with the largest share in international trade. C.

**Spanish Textile Industry: Development.** "*Times*" *Trade & Engineering*, 1944, 54, April, p. 18. According to statistics published by the Spanish Textile Syndicate, production of fabrics in 1943 amounted to 392,500,000 metres, an increase of 75,000,000 m., compared with 1942. This total consisted of 300,000,000 m. cotton fabric, 48,000,000 m. silk and 44,500,000 m. woollen fabric. About 11,430 enterprises, employing about 450,000 people, are engaged in the textile industry. In 1940 production of cotton amounted to over 10,000 bales, and in 1942 to 19,666 bales, and it is hoped that the figure for 1943 will be similar to that of 1942. The production possibilities of Spain have been estimated at 120,000 bales. In the provinces of Cordoba and Seville, the cotton growing areas, numerous mills have been erected in the last few years. Others are being built at Utera, Cordoba, Badajoz, Careres and Malaga with a capacity of 80,000 bales a year. Breeding of silkworms in Spain has increased considerably in the course of the last few years. This year's yield is estimated at 500 tons of cocoons, compared with 407 tons in 1943. About 80 per cent. of the entire production comes from the province of Murcia. The production of the silk industry has increased from 46,000,000 m. in 1942 to 48,000,000 m. in 1943, a figure which is 50 per cent. higher than in 1935. It is expected that once all measures taken by the authorities to improve silkworm cultivation in Spain have been completed Spain will be able to meet home requirements. C.

**Wool Products: Labelling; Australian Legislation.** "*Times*" *Trade & Engineering*, 1944, 54, April, p. 14. At the instance of the Commonwealth Government, the Australian States have agreed to introduce legislation providing for the uniform labelling of textiles to ensure that fabrics shall not be offered to the public as woollens unless they contain at least 92 per cent. of wool. The United States Wool Products Labelling Act, 1939, has been suggested as a model for uniform Australian legislation. A difficult problem is to ensure that imported piece-goods containing synthetic fibres carry into made-up garments the labels which Customs regulations require to be affixed to them on entry into Australia. One of the post-war objectives of the Commonwealth Government is the establishment of a textile college with research facilities to enable wool to hold its place against synthetic fibres produced from pulp, cotton or other cellulose base. C.

**Wool: Post-war Marketing.** G. E. Scott. *Wool Rec.*, 1944, 65, 172, 174, 176. Three principles are discussed: market stability by maintaining constant relationship between supply and demand with the resultant economic price; a system which permits and encourages continuous adaptation of standards and sources of supply; enterprise to experiment and pioneer. With the exception of

the indefinite contract, the pre-war system of wool marketing has proved its value, and should be reconstituted as soon as possible after the war. W.

**Wool Marketing Experiment: A Record of the Operations of the British Australian Wool Realisation Association.** G. J. Blau. *Wool Rec.*, 1944, 65, 333, 335, 337-8. W.

**"Wool in the World of To-morrow!"** F. Hopkinson. *Wool Rec.*, 1944, 65, 341, 343, 345. Future possibilities are discussed in regard to raw materials, machinery, and the production of yarns and fabrics. W.

**"The Truth About Wool."** H. F. Tomalin. *Wool Rec.*, 1944, 65, 171. It is suggested that the Board of Trade ruling on the term "wool yarn" should be changed, and that all members of the wool trade should contribute towards advertising wool and its basic value for clothing. W.

**Wool: Advertising Valuable Properties.** D. R. Christie. *Wool Rec.*, 1944, 65, 171. A plea for the more extensive advertising of the more valuable properties of wool fabrics, for the development of processing for water-proofing fabrics for post-war trade, and for the fixing of standards of manufacture to prevent misdescriptions. W.

**The Wool Industry and the Post-war World.** I. C. Ross. *Pastoral Rev.*, 1943, 53, 802-3, 1944, 54, 14-15. The possibilities of increasing the efficiency of wool production are discussed. Responsibility for textile research in Australia must be accepted, the prestige of wool maintained, and new markets developed. The scale of present-day research activities is hopelessly inadequate in relation to the gravity of the problems and the importance of the industry, and the immediate setting up is advocated of a central authority in Australia, to administer funds for biological, textile and economic research and for promotion and publicity. W.

**Pure Wool or Not?** W. R. Lang. *Pastoral Rev.*, 1944, 54, 18-19. The confusion arising from present-day descriptions of wool goods can only be removed by honest labelling, which should cover general serviceability of the fabric as well as fibre content. Simple tests are described by means of which the average customer can supplement the information given by handle and appearance of the fabric. W.

**What is Wool?** N. G. Baguley. *Text. Merc.*, 1944, 110, 239. The Retail Trading Standards Association is in favour of restricting the use of the word "wool" to the description of a substantially all-wool article, and of declaring the constitution of goods sold as "woollen." W.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY AND EDUCATION

**Cardroom Workers: Training.** *Cotton (U.S.)*, 1944, 108, No. 1, 109-112. The writer explains his method of starting learners at work and provides copies of (1) a daily work progress record and (2) a learner's work progress sheet. The latter sets out clearly how the learner will be paid and provides tables in which the manager enters week by week the number of frames run (drawframes and fly frames) and the percentage efficiency reached. It is explained that the minimum rate of pay—a time rate—will be changed to a piece rate as soon as the efficiency reaches the requisite high level. The learner signs a declaration of understanding of the progress sheet. C.

**Industrial Workers: Fatigue.** P. S. Florence. *Nature*, 1944, 153, 363-364. Experience in the study of industrial fatigue is discussed and it is suggested that "social medicine" can be regarded as an extension of such work and can be defined as the study of variations in human health and efficiency with variations in social living and working conditions. Such a study, aiming at the scientific observation of social norms of behaviour, can and (where laboratory experiment is impossible) must be based on statistical measurement and summarization. Full exploration must be made of the possibilities of vital statistics as a measure of health and efficiency as well as statistics of social conditions. Conditions relating to psychological social and family relationships have proved particularly difficult to observe and measure in fatigue studies and are likely to do so in social medicine. Further, different classes of persons will react dif-



ferently to similar conditions according to their heredity, sex, age, education and past experience. A chair of social medicine should, therefore, in a fully developed school, be supported by a staff that includes experts in demography and social statistics, in social psychology and anthropology, and in social biology. A general scheme of study for social medicine is outlined, and classical and recent research in social medicine is briefly reviewed. C.

**Knitting Operatives: Training.** H. E. Reed. *Textile World*, 1943, 93, No. 4, 108-109. The problem of training new employees in American knitting mills is discussed and the schemes adopted by some representative hosiery and underwear firms are described. C.

**Factory Noise: Reduction.** H. J. Sabine and R. A. Wilson. *J. Acoust. Soc. America*, 1943, 15, July, 27-31 (through *Sci. Abstr.*, 1943, 46 A, 232). Noise-level measurements in 33 plants of diverse nature varied between 65 and 130 decibels, and in the majority from 85 to 105 db. Factors other than noise-level contribute to the discomfort of the worker, namely, reverberation and the spreading-effect of sound or the tendency of sound in a non-absorbent room to decrease at a slow rate with increasing distance from the source. Further, a machine operator is affected less by the sound of his own machine than by others near him. Conditions favourable to improvement are: wide spacing of machines, differing qualities of noise from various units, and intermittent operation of the machines. In rooms where the smallest floor dimension is at least several times the ceiling height, and having a sound-absorbent ceiling (coefficient at least 0.7), the intensity level due to one or more sources decreases at a constant rate over the entire area of the room. This rate varies inversely with the ceiling height and may be 0.2 to 0.4 db./ft. C.

**Philadelphia Textile Institute: Research Work.** H. W. Rose. *Textile Research*, 1944, 14, 42-46. The dual objectives of research, knowledge and education, and the value of applied research in textile schools are discussed, and a brief account is given of the research work being carried out in the Philadelphia Textile Institute. Industrial problems are brought to this Institute by manufacturers, mills, factors in the trade, and by the Government. The research projects are arranged through the dean, who determines whether and when the work can be undertaken. Since it is difficult to estimate the exact cost of a project, the contract usually provides for periodic payments for a definite time. The research work is conducted by the faculty in its spare time. If appropriate, students may assist, and in some exceptional cases a project becomes part of the work of an entire class. Some subjects of research are undertaken by the Institute without sponsorship in the course of its regular work. C.

**Research Associations: Expenditure.** *Chemistry and Industry*, 1944, 168. Figures are given showing (1) the approximate expenditure of the 18 grant-aided research associations for the year 1942-43, (2) the net output of the industries concerned according to the Census of Production, 1935, and (3) the amount expended by the research associations per £100 of output. Research Association expenditure in 1942-43 varied from £7,200 for the boot and shoe industry to £115,200 for the cotton, silk and rayon industry, the expenditures per £100 net output being £0.04 and £0.17, respectively. The lowest expenditure per £100 output was £0.01 in the Printing and Allied Trades, and the highest £0.63 in the Refractories industry. C.



# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL.

**Sheep Scab: Elimination.** *Farmer & Stockbreeder*, 1944, 58, 658. If, in double-dipping areas, the first dip should be coloured bright yellow and the second bright red, this would facilitate the rounding-up of stray sheep, which are the potential scab-carriers. If the disease could be stamped out in this way, it is suggested that it might be worth while to suffer for a few years the inconvenience caused to the wool trade from coloured wool from scab areas. W.

**Tick-borne Diseases of Sheep: Occurrence and Control.** W. L. Stewart. *J. Min. Agric.*, 1944, 51, 23-27. W.

**Mammalian Hair: Morphology.** J. L. Stoves. *Nature*, 1944, 153, 285. Transverse sections are illustrated of the proximal and medial regions of guard-hairs from silver fox and kolinsky. The proximal regions show variation in fibre contour which occurs during atrophy of the hair root. W.

**Wool: Scale Structure.** W. B. Geiger. *Amer. Dyes. Rep.*, 1944, 33, 117-118; *Text. Res.*, 1944, 14, 82-85. The scale material left intact after dissolving the interior of the fibre (see these *Abs.*, 1942, A 199) has been reduced, alkylated and treated with pepsin by methods similar to those previously described (see these *Abs.*, 1941, A570 and 1943, A168). It is composed largely of protein and contains the same amino acids as untreated wool, but in different proportions, having more sulphur and serine and less nitrogen, arginine and tyrosine. The reduced scale material was more stable to enzymes and alkalis than reduced wool. W.

#### (C)—VEGETABLE

**World Cotton Crop: Production, 1943-44.** *Textile Weekly*, 1944, 33, 666. The output of cotton in the past three seasons, and forecasts for 1943-44, are tabulated for each country producing more than 25,000 bales and for the 35 other countries in which small crops are grown. The crop for the current season is expected to reach 26 million bales. C.

**Cotton Bales: Sampling.** R. W. Mitchem. *Textile World*, 1944, 94, No. 3, 88-89. Attention is called (with illustrations) to the dilapidation of cotton bales and consequent loss due to cutting the cover for taking a sample. The bill for new bagging in the United States is nearly \$10 million annually, though jute or cotton covers should last 25-35 seasons if stored in dry places and not cut. The writer suggests that a licensed grader and cotton classer should be attached to each ginnery to see that a duplicate sample of the cotton of, say, 7 lb. is fastened under the middle bale ties in a waterproof paper envelope. Sub-samples could be withdrawn but not replaced and the bale cover would be preserved. C.

#### (D)—ARTIFICIAL

**Cellulose: Preparation from Wood, Plants and Lignites.** A. W. Sohn. *Zellwolle, Kunstseide, Seide*, 1943, 48, 78 (through *Chem. Zentr.*, 1943, i, 2652 and *Chem. Abstr.*, 1944, 38, 1109<sup>5</sup>). By means of sodium chlorite, celluloses can be prepared that contain little lignin, an optimum amount of hemicelluloses, and an unchanged degree of polymerisation. Thus wood yields a white cellulose of maximum strength. Sodium chlorite is still more suited to treatment of annual plants, when combined with alkali pre-treatment or after-treatment. Pre-hydrolysed wood is improved only slightly by sodium chlorite; the improvement is greater on alkali after-treatment. Lignite when treated with sodium

chlorite gives satisfactory yields of a product that has a degree of polymerisation of 800, and contains uronic acids but little pentosans. C.

**Unbleached Pulp; Action of Nitrogen Dioxide on —.** E. Heuser and C. M. Sigvardt. *Paper Trade J.*, 1944, 118, TAPPI, 82-84. Samples of unbleached pulp of 1 and 6 per cent. moisture contents were treated with nitrogen dioxide at room temperature for periods of 15, 40 and 80 min., and an aqueous pulp suspension of 3 per cent. consistency was treated for 80 min. at 20° and 90° C. Lignin and nitrogen contents, permanganate numbers and viscosities were determined after washing with water and after extraction with caustic soda solution. The results show that delignification and degradation occurred simultaneously, but the latter proceeded at a somewhat slower rate than the former. The lignin content (1.80 per cent.) of the slush pulp treated for 80 min. at 20° C. and washed with water was of the same order as that of the 1 per cent. and 6 per cent. moisture pulps treated for 80 min. at the same temperature, but treatment for 80 min. at 90° C. followed by washing with water reduced the lignin content to 0.60 per cent. Thus temperature appeared to be the most important factor for delignification. All the treated samples contained measurable quantities of nitrogen. The results of these tests support the suggestion that the action of nitrogen dioxide upon unbleached pulp proceeds in two phases, nitration of the lignin residue and solubilization of the nitrolignin by oxidation. C.

**Viscose Staple Rayon: Spinning under Tension.** H. vom Hove. *Zellwolle, Kunstseide, Seide*, 1942, 47, 718-720 (through *Chem. Abstr.*, 1944, 38, 1109<sup>1</sup>). Replacement of mechanical stretching by tension produced by a current of the coagulating liquid is discussed; the alkali resistance of stretched staple fibre is greater than that of normal staple fibre. C.

**Viscose Rayon Factory: Hazards.** Alice Hamilton. *Bull. U.S. Dept. of Labor Division of Labor Standards*, 1940, No. 34, 79 pp. (through *Bull. Hygiene*, 1944, 19, 212-213). Risks of poisoning from carbon disulphide and from hydrogen sulphide are present in the viscose rayon industry. In one plant 143 p.p.m. of carbon disulphide were found in the air at the churn door and 139 p.p.m. in the centre of the room. By careful control the concentrations can be brought below 15 p.p.m. In the spinning process, acid spray, carbon disulphide and hydrogen sulphide are evolved. Measures for the control of acid spray also control the two toxic gases. Cases of conjunctivitis give evidence of the presence of hydrogen sulphide. Fumes of carbon disulphide and hydrogen sulphide are evolved in reeling, washing, desulphurising and bleaching processes. The toxic effects of daily exposure to carbon disulphide are apparent before acute symptoms develop though cases of sudden insanity have occurred. The peripheral nerves of the ear, eye or muscles may be affected. The most striking effects of carbon disulphide poisoning are upon the brain. The mental symptoms vary from simple irritability and depression to insanity. If the basal ganglia are involved Parkinsonian palsy occurs. Details of 27 cases are quoted. Poisoning by fumes of hydrogen sulphide is a less serious hazard. A few cases of acute intoxication have been reported, but the patients have generally been resuscitated. The milder troubles are inflammations of the eyes which subside in 48 hours, although in severe cases corneal involvement may develop. The following limiting concentrations are recommended: for carbon disulphide 20 p.p.m. and for hydrogen sulphide 20 p.p.m. for eight hours, 30 p.p.m. for one hour. C.

**Interpolyamide-ester Nylons: Production and Properties.** *Silk & Rayon*, 1944, 18, 544-548. Attention is called to the possibility of producing a wide range of nylons by condensing the dibasic acid component with a glycol as well as a diamine (see B.P. 535,262; E. I. Du Pont de Nemours Co.). Tables and curves are reproduced to show how the melting points, hardness and elasticity of the nylon vary with the proportion of glycol in the batch. C.

**Nylon, Acetate and Viscose Rayons and Vinyon: Recent Developments.** (1) R. A. Ramsdell. (2) H. De Witt Smith. (3) & (4) F. Bonnet. *Amer. Dyes. Rept.*, 1944, 33, 121-123, 124-125 and 128, and 126-127, 127-128. (1) A review of the development of nylon, progress in methods of dyeing and finishing, uses and advantages of nylon yarn, and the use of nylon for the production of coated materials, bristles and other articles. (2) Figures showing recent increases in

the production of acetate rayon in the United States are given, types of continuous filament acetate yarns now being produced and their physical properties are described, characteristics and uses of acetate staple fibre are outlined, special types of textile fibres employing cellulose acetate are mentioned, and recent developments in dyeing and finishing, particularly improvements in light fastness and fume fastness and the development of discharge printing, are reviewed. (3) A brief discussion of the development of strong continuous filament viscose rayon yarns and special yarns for special purposes, and of the characteristics and uses of the various types of viscose staple fibre. (4) The properties and uses of Vinyon are briefly described. C.

**Hot Water-resistant Casein Fibres: Production.** A. M. Kats and G. A. Arbuzov. *J. Applied Chem. (U.S.S.R.)*, 1943, 16, 134-142 (through *Chem. Abstr.*, 1944, 38, 1371<sup>2</sup>). With increased temperature and duration of tanning and higher formaldehyde concentration, the binding of formaldehyde by casein fibres increases; however, increased formaldehyde content lowers the fibre strength. The best results were obtained with formaldehyde concentration of 50 g./l., sodium sulphate 150 g./l., temperature 25°, duration 8-10 hours, pH 4.5-5. Retanning with formaldehyde of fibre tanned either with formaldehyde or chrome increases both dry and wet strength. In chrome tanning, increased chromic oxide concentration, basicity, temperature and duration lead to higher chromium concentration on the fibre; after chrome tanning and washing, the fibre should be neutralised with alkali salts. C.

**"Avisco" Rayon Staple: Properties.** American Viscose Corporation. *Silk and Rayon*, 1944, 18, 375. It is announced that a strong type of viscose staple is on the market in 1.0 den. and various lengths. The material has been spun in counts as fine as 300s. C.

#### PATENTS

**Cellulose and Lignin: Recovery from Wood.** R. H. McKee (New York). B.P.560,492 of 30/6/1942:6/4/1944. Wood or other lignified cellulose material is digested for about 12 hours at a temperature of 150° C. with a hydrotropic solvent comprising an aqueous solution of a readily soluble salt of an aromatic acid derived from a single benzene ring. At the end of this treatment the cellulose is filtered from the accompanying liquor, which contains lignin in solution in the state in which it originally occurred in the wood. The cellulose is washed, preferably with the hydrotropic solvent in diluted condition, and may then be bleached by customary methods. The cooking solution, after the separation of the cellulose therefrom, is used again, preferably six or seven times, after which it is diluted with at least three times its volume of water to precipitate the lignin. The lignin is filtered and washed, and can then be used for various industrial purposes. C.

**Vinyl Resin Mono-filaments: Production.** American Viscose Corporation and K. Heymann. B.P.560,535 of 26/8/1942:7/4/1944 (Conv. 1/10/1941). A bundle comprising thermoplastic vinyl resin filaments which have been stretched in excess of 50 per cent. at some time during their production is twisted and converted directly by heating, while taut, into a unitary filament having to all appearances the structure of a true mono-filament. Preferably, a twist of from 3 to 10 turns per inch is employed to obtain the greatest uniformity and resistance to abrasion in the product. A fluid heat transfer medium is preferred. The bundle may be treated in the form of an unwound yarn or in package form. C.

**Rayon Spinning Box.** American Viscose Corporation. B.P.560,616 of 10/2/1943:12/4/1944 (Conv. 18/3/1942). A spinning box comprises a hub portion having a central bore adapted to receive driving means, and a member carried by the hub portion and arranged to be actuated by centrifugal force to effect positive coupling between the spinning box and the driving means whereby the spinning box is positively driven. C.

**Chlorinated Vinyl Co-polymer Filaments: Production.** American Viscose Corporation. B.P.560,660 of 27/1/1942:14/4/1944 (Conv. 22/7/1941). A solution of a co-polymer of vinyl chloride and vinyl acetate having a molecular weight of at least 1,500 and containing about 80-95 per cent. by weight of vinyl chloride, is chlorinated until the final product has a total Cl content of about 58-64 per cent. by weight whereby the product acquires a shrinkage tem-

perature range above 100° C. and improved solubility characteristics. The shrinkage temperature range is defined as the 5° C. range of temperature through which 5 per cent. shrinkage occurs as a filament is subjected to gradually increasing temperatures. The chlorinated co-polymer is precipitated from solution, washed, and, if desired, dried. The product may be dissolved and spun by wet or dry processes, and the filaments may be stretched at temperatures about 40-50° C. above their shrinkage temperature range. C.

**Rayon Staple Cutting Apparatus.** American Viscose Corporation and H. H. Bitler. B.P.560,670 of 31/8/1942: 14/4/1944 (Conv. 12/3/1942). In apparatus for cutting rayon staple of the kind in which a bundle of continuous filaments is subjected to successive severing operations, there are provided means for feeding the bundle at a constant speed, a number of cutting elements having different spaces between them for cutting the bundle into fibres of various lengths, and means for adjusting the distance between the cutting elements. The cutting elements may be disposed at unequal distances apart about the periphery of a rotatable member. C.

**Polymeric Urea Derivatives: Production.** H. Dreyfus. B.P.560,784 of 23/1/1939:20/4/1944. Condensation polymers of high molecular weight suitable for the production of filaments, films, and coating compositions are produced by heating certain organic compounds containing only two reactive radicals of which at least one is the radical of urea, thiourea or a similar compound, e.g. N:N'-dimethylurea or N-methyl-thiourea, and has the formula  $-NR.CX.NHR_1$ , where R and  $R_1$  are each H or a hydrocarbon radical and X is O or S. One or more organic compounds each containing only two reactive radicals, each of which has the formula  $-NR.CX.NHR_1$ , may be heated until a product having filament-forming properties is obtained, or an organic compound containing only two reactive radicals, each of which is a primary or secondary amino group, may be heated with an organic compound containing only two reactive radicals, one of which has the formula  $-NR.CS.NHR_1$  and the other has the formula  $-NR.CX.NHR_1$ . The compounds employed are preferably aliphatic compounds particularly ones in which the pairs of reactive radicals are linked by chains of methylene groups or at least attached to methylene groups. C.

**Linear Polymeric Urea Derivatives: Production.** H. Dreyfus. B.P.560,785/6 of 23/1/1939:20/4/1944. (1) Linear polymeric compounds of high molecular weight suitable for the production of filaments, foils, films and other articles are produced by linking up molecules of simple organic compounds by heating them so as to effect reaction between radicals having the formula  $-NR.CO.NHR_1$ , where R and  $R_1$  each represent a hydrogen atom or a hydrocarbon radical, i.e. radicals of urea and hydrocarbon substitution derivatives thereof, and hydroxy groups present in the organic molecules. Each of the compounds employed contains in the molecule two and only two radicals which are reactive under the conditions employed for the production of the polymer. Preferred compounds are aliphatic compounds in which the reactive radicals are linked by methylene groups, e.g. trimethylene, tetramethylene, hexamethylene and decamethylene di-ureas, the corresponding glycols and the corresponding hydroxy-ureas. In order to obtain products having suitable properties for the formation of filaments, it is in general necessary to continue the reaction until the polymer has an average molecular weight of 6,000 to 10,000 or more. Filaments, films and similar products formed from the polymers may be cold-drawn or stretched, either continuously with their production or subsequently thereto. (2) Linear polymeric compounds of high molecular weight suitable for the production of filaments, films, coating compositions and other articles are produced by heating a diamine with an organic compound containing only two reactive radicals, one of which is a carboxylic acid radical or amide-forming derivative thereof and the other of which is a radical having the formula  $-NR.CO.NHR_1$ , where R and  $R_1$  each represent a hydrogen atom or a hydrocarbon radical, heating being continued until a product having film-forming properties is obtained. Each of the compounds employed contains only two radicals which are reactive under the conditions employed for the production of the polymer. The urea acids and their derivatives, which it is preferred to employ are those characterised by a chain consisting of methylene groups linked at one end to a radical of urea or a derivative thereof and at the other end to a carboxylic acid radical or an amide-forming derivative thereof. C.

**Staplisled Rayon Yarn: Production from Continuous Filaments.** J. Mackie & Sons Ltd. and J. P. Mackie. B.P.560,902 of 23/10/1942:26/4/1944. A machine for the manufacture of staplisled yarn from continuous filaments by a process of drawing and breaking the filaments and spinning the staple fibres as they are delivered includes feed rollers running at a low speed, breaking rollers running at a high speed, intermediate guiding and restricting means for controlling the sliver while it is being broken, and means for stretching the sliver before it is delivered to the feeding rollers in order to ensure that the filaments are delivered in a straightened and stretched form at the feed rollers, said means preferably comprising an additional pair of rollers with their nip at a distance of about a yard from the nip of the feed rollers, and either driven at a surface speed a little below that of the feed rollers, or subjected to drag by a braking device. The means for guiding and restricting the sliver between the feed rollers and the breaking rollers may include a restricting tube or channel, open at the top and preferably somewhat arched in form, which delivers the sliver to a travelling throat formed by a gap in the opposed surfaces of two geared rollers meshing together and rotating at a speed not much above that of the feed rollers. A set of faller bars may be used to keep the fibres straight just before they reach the point of entry to the gap between the breaking rollers. C.

**Viscose: De-aeration.** British Cellophane Ltd. B.P.561,050 of 16/7/1942:3/5/1944 (Conv. 18/7/1941). A continuous process of de-aerating aqueous viscous liquids, e.g. viscose, containing air or other gas, which comprises introducing the liquid continuously into a container, flowing the liquid in a layer or film of substantially uniform thickness in contact with the side walls of the container, subjecting the flowing film or layer of the liquid to a vacuum sufficiently high to cause the liquid to boil throughout the thickness of the layer or film, whereby removal of water together with the air or other gas takes place, is characterised in that the vacuum is controlled so as to maintain constant during the process the rate of removal of water per unit volume of liquid. C.

**Mechanical Cotton Picker.** A. W. Weems (Meridian, Miss.). U.S.P.2,333,965. A cotton harvesting machine has a bank of picker spindles revolving in horizontal vertically spaced tiers, a bank of stripper fingers that pass through the spaces between adjacent tiers of picker spindles, and means to produce air currents and suction to remove the lint from the spindles. C.

**Rayon Yarn Stretching Apparatus.** Celanese Corporation of America. U.S.P. 2,334,288. Apparatus for stretching a single end of rayon consists of a chamber containing a softening medium, means for feeding the yarn to the chamber and drawing it away, and means responsive to the degree of softness of the yarn for directing the path of the yarn on the withdrawing mechanism so as to change its speed of travel. C.

**Rayon Continuous Spinning and Treating Apparatus.** American Enka Corporation. U.S.P.2,334,325. Rayon is spun from a number of spinnerets in a bath and the threads are led in parallel rows to a set of pairs of upper and lower grooved rollers, there being as many grooves as threads. Groups of these rollers are provided with treatment tanks, and the bottom rollers are submerged in the liquid. The individual ends are wound into separate packages. C.

**Titanium Salt Delustred Rayon: Production.** American Enka Corporation. U.S.P.2,334,358. Dull rayon is spun from a cellulosic solution containing the titanium salt of a polymerised, unsaturated carboxylic acid having as substituents in the unsaturated aliphatic chain only hydrocarbon or carboxyl radicals or halogens; e.g. the copolymer of acrylic acid and vinyl chloride. C.

**Mineral Acid Solution of Cellulose: Spinning.** H. Fink, G. Rath and R. Hofstadt (Germany; vested in U.S. Alien Property Custodian). U.S.P.2,334,615. A suspension of cellulose in a mineral acid that is strong enough to cause swelling is fed continuously to an extruding device, together with sufficient mineral acid to complete the dissolution, the amount of solution formed in unit time being maintained equal to the amount passing through the spinneret. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Rayon Staple Opening Machines: Types and Beater Speeds.** *Textile World*, 1944, 94, No. 2, 109-110. Particulars of the sequence of opening and scutching machines, types of beater, and beater speeds are tabulated for ten different mills in the United States, together with information about the type of rayon staple and yarn count. The wide variations (e.g. beater speeds from 300 to 1050 r.p.m.) suggest the need for experiment to decide the best conditions. C.

**Cardroom Machinery: Modernization.** J. Buckley. *Textile Weekly*, 1944, 33, (1) 672-6, 710-4, 752-4; (2) 790-2, 824-6. (1) An illustrated report of a lecture on the construction, installation and efficiency of the following machines and appliances: (i) Sliver lap former, (ii) the Lap draw frame, (iii) Sliver cans, 12-in. diameter, and (iv) Platt's high-draft speed frame. A discussion is reported. (2) An illustrated report of another lecture in which the economy is stressed of the "combined operations" made possible by adopting the above machines. C.

**Roller Card for Long-staple Rayon.** Whitin Machine Co. *Textile World*, 1944, 94, No. 3, 105. An illustration is given of a new roller card for long-staple rayon (especially that over 2 ins.) which employs a double-lap feed, a set of six worker and stripper rollers instead of flats, a two-coiler front, and an improved bonnet to control the air currents. Under normal conditions the output is about 25 lb. per hour and the waste not more than 0.75 per cent. C.

**Post-war Woollen Carding.** G. Marshall. *Text. Mfr.*, 1944, 70, 165-167. Various arrangements of parts in woollen carding machines and their relative merits are discussed, particularly the Continental type of arrangements and a 4 lick-in section as used in worsted carding. For card clothing, thick felt fillet has many advantages. The use of low-quality wool oil does not necessarily save costs. Suggestions are made for obtaining a high level of efficiency on existing machinery, especially as regards worker and doffer speeds and the cleaning of card surfaces. W.

**Card Clothing: Efficient Use.** G. Marshall. *Wool Rec.*, 1944, 65, 550, 552; 554. English and Continental types of card clothing are compared. Continental-type cards are easier to keep clean owing to shorter length of wire above the foundation. Methods are suggested for obtaining maximum efficiency on English-type cards, e.g. by fitting dick-rollers on all doffers, by using efficient fly-strippers, by paying special attention to clothing of the swifts and by correct fettling. W.

**Maintaining Drawing Production.** *Wool Rec.*, 1944, 65, 625, 627. Drawing production can be maintained with a reduced number of operatives by using one end instead of two at the rover. Tables are given showing the necessary draft and doubling changes for 8- and 7-operation sets. W.

### (B)—SPINNING AND DOUBLING

**Cotton Mill Waste: Control.** T. Robinson. *Cotton (U.S.)*, 1944, 108, No. 2, 91-92. The writer advocates the appointment of a "waste control supervisor" whose duties are (1) to decide with foremen in all departments of the mill what types of waste are avoidable or not, (2) to maintain the waste percentages in various departments, (3) to arrange for the re-working or marketing of wastes and (4) to stimulate "waste consciousness." C.

**Cotton Mill Waste: Reduction and Utilization.** Joanna Textile Mills Co. (Goldsville, S.C.). *Textile World*, 1944, 94, No. 2, 112-113. Some particulars are given of the percentages of waste produced at various stages in the cardroom, spinning room, warping department, weaving shed and cloth room of an American mill consuming about 2000 bales of cotton per month. Figures are tabulated for 1940 and for 1943, after the introduction of various improvements that have brought the total waste from 11.32 to 9.56 per cent. The mill makes two special cloths from the waste, an osnaburg for bale covering and a tape frame blanket. The latter is plain woven from the same warp (lightly sized) and weft, 62 inches wide, 14 × 14, 0.7 yd. per lb., and is napped on the outer face. Fifteen yards are used for each squeeze roller and the blanket lasts for 8-12 weeks. The mill saves about \$500 per tape frame per annum by comparison with the conventional woollen blanket. C.

**Mule Spinner's Change and Wage Tickets: Application.** *Textile Weekly*, 1944, 33, 706-709. Hints are given on the rational use of change tickets and count determinations ("wrappings") for keeping records of the wheels employed in the spinning of a particular yarn and for calculating wages. C.

**Speed-frame Products: Effect of Doubling on Yarn Strength.** *Cotton (U.S.)*, 1944, 108, No. 2, 142-144. Further evidence is given that the Draper standards for yarn strength can be reached with few doublings. Particulars are given for two mills producing warp yarn ( $21\frac{1}{2}$ s) from 1-in. Middling cotton; in one mill there were only 16 doublings in the card room and double creeling in spinning, and in the other mill 32 doublings and single creeling. The count-strength products were the same and above the Draper standard. C.

**Woollen Fibres: Pot-spinning.** J. McCann. *Text. World*, 1944, 94, No. 2, 97-98. A pot-spinning frame for woollen-type yarns is described; it is not yet available commercially, but a 30-spindle frame has been demonstrated. The yarn is built up by centrifugal force inside the revolving pot. The pot is directly below the front roller nip and the yarn enters through a central tube. A fan built into the bottom of the pot sucks the yarn into the pot through this tube. Drafting is done in the way usual on woollen spinning frames, i.e. using a false twist tube, but the front rollers are of new design, and are in two pairs. In each pair one roller is cut away so that it contacts the other for only part of its revolution. The contacts on the two pairs are staggered so that only one pair grips the yarn at the same time. This allows twist provided by the false twist tube to flow and merge with that provided by the revolving pot. It is claimed that the machine gives high-speed production of large-size packages of unusually even and lofty yarn, and that defects are minimised by the very simple manner of piecing. Worsted, mohair, rayon and other fibres have also been spun by this method. W.

#### (C)—SUBSEQUENT PROCESSES

**Curling Yarn for Pile Fabrics.** "Concord." *Text. Merc.*, 1944, 110, 153-155, 159, 179-180, 220, 223. Types of curl imparted to animal fibre yarn are described, an irregular pattern giving a better imitation of the animal pelt. The Broadbent continuous yarn curling machine reproduces indefinitely any curl pattern on warp of the same kind, and has a large output for a low labour cost, as compared with hand-curling. The importance is emphasised of the boiling or setting operation, the best apparatus for this being a vessel fitted with a rotatable container for the stock, a dyeing machine of the Klauder-Welldon type being suitable, if it is used for no other purpose, and if the container is geared down to rotate at a single rev. every 10 min. Soft water must be used. The duration of the process varies from 1-4 hr. After boiling, the fibres are rapidly chilled to set the twists, and the stock is dried. The final operations are opening and sizing. The goods when woven are pressure-steamed in a cottage apparatus for 1 hr. at 5-10 lb. per sq. in. pressure. For "print" style astrakhan, dyeing and setting are combined, and for a black and white effect the warp is blued before curling and chromed after curling. W.

#### (D)—YARNS AND CORDS

**Nylon Rope: Uses.** *British Plastics*, 1944, 16, 153. A nylon rope of about half an inch diameter can lift a load of 3 tons and is about twice as strong as a manila rope of the same thickness. Its weight is half to two-thirds that of a manila rope of equal diameter. The elasticity of a rubber band or a steel spring expresses itself in a quick snap. Nylon rope, in contrast, has a slow, gentle "bounce." Under stress of a sudden pull, nylon rope stretches rapidly but recovers slowly, the action of the perfect shock absorber. This shock-absorbing characteristic provides one of the advantages of the use of nylon mailbag loops and winch lines for the picking up of air-mail by travelling planes. Nylon ropes are also used for gliders and as climbing ropes for mountain troops. C.

**Wool Crêpe Yarns: Manufacture.** S. Kershaw. *Text. World*, 1944, 94, No. 2, 111, 120. Methods are described for spinning and twisting singles crêpe yarn, and also Z on S and Z on Z twist yarns, and examples given of the count and twist allowances to be made for yarn contraction. Precautions necessary to prevent snarls are suggested. W.



## PATENTS

**Spinning Frame Clearer Roller.** Dominion Textile Co. Ltd. (Montreal). B.P. 560,381 of 24/9/1942:3/4/1944 (Conv. 1/10/1941). A clearer roller for spinning frames and like textile machines comprises a hollow cylindrical form, a cloth cover mounted on the form and secured to the surface thereof with its free ends in-turned over the ends of the form, and a plug inserted in one or each end of the form to engage one or each of the free ends. The plug may be mushroom shaped with the stem portion extending within the form. The roller may comprise two or more hollow cylindrical forms connected and spaced apart by a plug or plugs carrying a collar or collars of a smooth wear-resistant material serving as friction-free journals by which the roller may rotate against stationary bearings. The cloth cover may be a braided tube. C.

**Rayon Staple: Spinning on Flax Spinning Frame.** J. Wilson and W. Gibson (Belfast). B.P. 560,635 of 7/8/1942:13/4/1944. In a wet spinning frame of the type used for flax means are provided to enable the drawing and dry spinning of rove of which the staple length is greater than that of the normal maximum reach of the frame, e.g. "Fibro" having a staple length of about 4 inches. The means comprise a guide offset from the path of the normal straight reach so that the rove passing from the retaining to the drawing rollers and over the guide means consists of two stretches angularly related to the normal path and of greater total length than said path and of which the stretch between the guide and the nip of the drawing rollers is sufficiently greater than the length of the normal maximum reach to allow the necessary drawing action. The guide may comprise a guide bar so offset from the normal reach that the rove passing around the bar is subjected to a change of direction of the order of 180° and a consequent frictional drag. C.

**Carding Engine Ventilation and Dust Removal Apparatus.** S. Holt. B.P. 560,969 of 9/12/1942:28/4/1944. Ventilation and dust removal apparatus for cotton carding engines consists of a fixed self-contained unit supported above the cylinder, doffer and licker-in, the unit comprising a motor-driven fan having a vertical axis, a dust filter or separator on the fan outlet which returns the filtered air to the cardroom, and a hood on the fan inlet located over the machine so as to confine fluff or dust given off by the machine to an area to which suction is applied. The portion of the hood which extends over the doffer may telescope within the centre portion of the hood so as to give access to the doffer when the stripping of the latter of the hard nebs which become embedded therein is to be performed, the telescoping part being replaced in its extended position during the actual stripping operation. Similarly, the portion of the hood which extends over the licker-in may be hinged to the remainder. Side flaps, which may be made of sheet metal, may be suspended from the hood by hooks. C.

**Ring Traveller.** P. C. Wentworth. U.S.P. 2,333,755. The traveller comprises a bow and terminal horns that are split centrally and opened out so that they provide a wider bearing surface on the ring. It is claimed that the traveller is much less likely than usual to swivel and ride the ring flange. C.

**Wet Twisting Frame.** H. V. Lang (Charlotte, N.C.). U.S.P. 2,334,420. Yarn from supply packages passes through tension rollers, then over a roller (A) rotating at an adjustable speed in a trough containing a treating solution, and is twisted by means of a ring and traveller combination (B). Between (A) and (B) the yarn rubs along a curved trough which can be swung out of the way for doffing. C.

**Knub Yarn Production Apparatus.** Alexander Cavedon (Woonsocket, R.I.). U.S.P. 2,334,542. Apparatus for making knub yarns comprises means for conveying a web of carded fibre to a condenser, rollers controlled by a ratcheting device for feeding a predetermined length of knub material to a fixed and a movable cutting blade, and means for depositing the cut knub material uniformly across the card web. C.

## 3—CONVERSION OF YARNS INTO FABRICS

## (B)—SIZING

**Rayon and Cotton Warp: Sizing.** O. Pennenkamp. *Spinner u. Weber*, 1943, 61, No. 4, 2-6 (through *Chem. Zentr.*, 1943, i, 2367 and *Chem. Abstr.*, 1944, 38, 1119<sup>b</sup>). The requirements of a good size, hank and warp sizes, advantages of



the latter, and sizing agents for slasher sizing are discussed and numerous sizes for general and special purposes, particularly for staple fibre, are listed. C.

**"Cellufix" Paste: Uses.** *Nature*, 1944, 153, 616. The Swedish Cellulose Co. has recently put on the market a wood-pulp product named "Cellufix," the manufacture of which requires the use of alkali, chlorine and alcohol. It is odourless and tasteless, soluble in water, and a 3 per cent. solution has the consistency of butter. At present it is mainly used as wall-paper paste, as putty, for part of white-wash, and in textile mills as size and for other purposes. A specially purified quality of Cellufix, called "Cellugel," is used in the food and chemical industries to give bulk to certain products and is also a substitute for glycerin. C.

**Infra-red Drying Lamps: Application in Sizing.** Ware Shoals Manufacturing Co. (S. Carolina). *Textile World*, 1944, 94, No. 3, 83. An illustrated account is given of an application of infra-red lamps by which a 40 per cent. increase of production was secured at the tape frame. An asbestos hood, 7 ft. long, 57 ins. wide and 16 ins. deep, with protective flaps hinged to the sides, is suspended over the warp sheet between the size box and the usual drying cylinders, which operate as usual. The hood is wired for 120 Westinghouse infra-red lamps (250-watt, 110-volt). A sheet of metal below the warp is suggested as a reflector to dry the under surface. C.

**Tape Frame: Speed Calculation.** H. D. Tendulkar and D. F. Kapadia. *Indian Textile J.*, 1944, 54, 187-189. The authors analyse the physical factors that govern the output of the tape frame, and argue that the number of ends in the warp sheet is without influence on the speed of the machine, but that the air gap between the warp and the surface of the drying cylinders is responsible for most of the loss of thermal efficiency. They derive the following equation connecting the speed,  $S$  (yards per second), count of yarn,  $n$ , percentage of dry size added,  $s$ , and percentage of free water that has to be evaporated,  $p$ :  $S = 31.8(n/s) \cdot \{ (100-p)/p \}^{1/2} \cdot 1/(29+0.8n)$ . A table shows values of  $S$  calculated for  $n$  20-120,  $s$  50-10 and  $p$  30-88; they range from 42.6 to 24.9 yards per minute and agree with what is said to be "general mill practice." C.

**Cotton Mill Waste: Reduction and Utilization (for Tape Frame Blankets).** See Section 2(B), above.

#### (C)—WEAVING

**"Bracewell" Automatic Loom.** Messrs. Greaves Cotton & Co. Ltd. (Agents; Bombay). *Indian Textile J.*, 1944, 54, 194-195. An illustrated description is given of a loom, now being manufactured in India, that combines a circular shuttle box for four shuttles with a hammer pirn-changing motion for replenishing an exhausted shuttle from a magazine. When the weft in the operative shuttle is spent, a weft-feeler motion or weft-fork causes a quarter rotation of the shuttle box, thus bringing a full shuttle into play. This is then picked to the opposite side of the loom and when the sley is next at front centre the transfer hammer brings a fresh bobbin from the magazine into the exhausted shuttle and ejects the empty bobbin. The mechanism can be applied to ordinary over-pick looms after minor alterations. C.

**Loom Picking Motion: Adjustment.** *Cotton (U.S.)*, 1944, 108, No. 2, 137-139. Practical hints are given on the adjustment of the picking motion, with special reference to the relation between picking and (1) shedding, (2) the fell of the cloth and (3) "banging off." C.

**Rayon Loom: Maintenance.** A. C. Wayman. *Textile World*, 1944, 94, No. 2, 116-117. Hints are given on the routine to follow when cleaning a loom, replacing worn parts, oiling, and starting again. A record chart is reproduced for filling in by the responsible workers when "warps are out." C.

**Damaged Cloth: Tracing Responsibility.** *Textile Weekly*, 1944, 33, 794-8, 836-840. Practical hints are given on the causes of various types of damage in cloth, and the responsibility for them of the weaver and the overlooker. C.

**Rayon Fabric with Holes and Floats: Correction in Weaving.** H. E. Wenrich. *Rayon Textile Monthly*, 1943, 24, 644-6; 1944, 25, 26-27, 82, 131-132, 179-180. Practical advice is given on the reduction of floats and holes in weav-

ing rayon, including the ripping out and repair of floats, effective admonition of the weaver, and the influence of bad sizing, rough shuttles, timing the shedding and heald lifting, knots, the height of the shed, timing the pick, loose yarn on the beam, breaking of selvage ends, and the covering of the take-up roller. C.

**Weft Bars in Rayon Fabrics: Prevention.** *Silk and Rayon*, 1944, 18, 430-432. Practical hints are given on the avoidance of weft bars in rayon crêpes, taffetas, etc., chiefly those due to a faulty ratchet wheel in the take-up motion and to a wrongly set beam motion. C.

**Automatic Looms: Developments.** *Wool Rec.*, 1944, 65, 591-592. The extent to which textile machinery was imported from the Continent before the war is discussed, with particular reference to developments in automatic looms. Automatic weaving and winding machinery is now being given some attention in this country. W.

**Worsted and Mohair Mixture Cloths: Weaving.** "Practical Overlooker." *Text. Rec.*, 1944, 61, No. 732, 48-50. Practical suggestions are made for overcoming difficulties in the weaving of plain cloth with worsted warp and mohair weft. W.

#### (G)—FABRICS

**Rayon Shirting: Specification and Testing.** P. Lebrun. *Textile World*, 1944, 94, No. 2, 120. American Navy Specification No. 55-B-18a calls for a shirting for blouses for the women's services, with the following minimum particulars: 112 ends per inch of continuous-filament viscose yarn, 72 picks per inch of spun viscose, 3.2 oz. per sq. yd., warp and weft breaking loads 50 lb., shrinkage in wash 2 per cent., either way. The material is white or dyed navy blue and if dyed should be fast to washing at 160° F. with soap and soda ash, fast in a Fadeometer exposure of 40 hours. Hints on finishing the cloth are given; impregnation with 2-3 per cent. of a melamine resin is recommended. C.

**Shirley Institute Water-repellent Cotton Fabric.** *Textile World*, 1944, 94, No. 3, 85. A hint is given of the interest aroused in the United States by the B.C.I.R.A. development of water-repellent canvas and uniform fabrics. Some particulars of their construction are reproduced from the British patent specification No. 549,974. A similar experimental cloth produced in the United States is an Oxford fabric, 136 × 52, 60/3s in both warp and weft, the twist factor of the singles in the warp being 2.75. C.

**Terry Towel Cloth: Costing.** O. Pomfret. *Textile Manufacturer*, 1944, 70, 150-3, 157. Methods of costing in the terry trade are discussed and an example is worked out by three methods that differ in detail. C.

**Weaving Calculation Tables.** E. Whitworth. *Textile World*, 1944, 94, No. 3, 84-85. The following examples are given of tables to facilitate weaving calculations: (1) Production in thousands of picks by a loom running at 132 p.p.m. for 40, 32, 24, 16, 8 hours or 1 hour at various efficiencies down to 76 per cent.; (2) Costs per yard of cloths from 110 to 56 picks per inch at 1, 2, 3 . . . 9 cents per 1,000 picks. C.

**Utility Fabrics: Conception, Birth and Development.** Sir Thomas Barlow. *J. Soc. Dyers & Col.*, 1944, 60, 53-55. W.

**Felt Hat Making.** F. J. Knight. *Canadian Text. J.*, 1944, 61, No. 4, 42, 44, No. 5, 37, 39. A description of the manufacture of fur and wool felt hats, from the selection and blending of the raw material to the finishing operations. W.

**Military Fabrics: Serge.** *Text. World*, 1943, 93, No. 12, 80-83. An abstract is given of U.S. Army Specification No. 8-94 A. for 18-oz. serge, together with detailed suggestions for manufacturing and finishing procedure. W.

#### PATENTS

**Cross-wound Cop Winding Machine.** Maschinenfabrik Schweiter A.-G. (Switzerland). B.P. 560,319 of 1/7/1942: 30/3/1944 (Conv. 1/7/1941). A cross-wound cop winding machine for winding conical cops with conical ends on conical bobbins includes a slider which is reciprocated with a constant stroke by means of a throw rod and carries an oscillatable thread guide arm operatively connected to a pivoted slide link in such a manner that the degree of oscillation

of the thread guide is controlled by the inclination of the slide link relative to the line of movement of the slider. These parts are oscillatably mounted as a whole about an axis parallel to the line of movement of the slider so that with an increase in diameter of the cop being wound the said parts are caused to swing as a whole about the axis by reason of the engagement of the thread guide with the cop in such a manner that with an empty bobbin the slide link is so positioned that the maximum movement of the thread guide results from the combined oscillation of the thread guide arm and the motion of the slider whilst with increasing diameter of the cop the position of the slide link is varied to cause the movement of the thread guide arm to be gradually reduced to a minimum. The axis of the bobbin to be wound is inclined to the axis of the throw rod so that the line traced by the thread guide on the cop runs parallel to the taper of the conical bobbin on which the cop is being wound. Preferably the slide link is pivotally mounted on an axis at right angles to the line of movement of the slider. C.

**Double-pick Loom.** H. Seal & Co. Ltd. and J. Webster. B.P. 560,330 of 28/9/1942:30/3/1944. A loom of the type having a batten or sley movable to-and-fro in beating up is provided with means for making two picks for each revolution of the main shaft, for shedding between successive picks, and for beating up after every second pick. Conveniently, the shuttle is driven by a two-lobed tappet or cam on the half-speed shaft. The sheds are made by a suitable arrangement of healds operated from a dobby or tappets or both. C.

**Nylon Yarn: Sizing and Twisting.** E. I. Du Pont de Nemours & Co. B.P. 560,538 of 5/10/1942:7/4/1944 (Conv. 4/10/1941). A method of producing a highly-twisted and sized nylon yarn in a continuous operation, comprises sizing and winding a nylon yarn having less than five turns per inch twist, drying the sized yarn during the continuous operation at a temperature up to 50° C. at a sufficiently high rate so that the completely wound package has a moisture regain of not more than 12 per cent., and subsequently imparting a twist in excess of 15 turns per inch to the yarn. Examples are given of the sizing of 30-denier, 10-filament yarn, using a basic size composition containing partially hydrolysed polyvinyl acetate, boric acid and polyethylene glycol. C.

**Tapered Package Winding Apparatus.** Courtaulds Ltd. and C. H. Hampson. B.P. 560,637 and 560,657 of 21/8/1942:13/4/1944. (1) Apparatus for winding thread packages tapered at each end comprises a roller mounted on a thread guide arm which is fixed on an axle and connected by an intermediate bracket to a short rod passing through a slot in a lever that oscillates about a fixed fulcrum, the whole being so arranged that as the distance between the thread guide and the roller increases, the short rod moves in the slotted lever towards the fulcrum, and so causes the traverse given by the slotted lever to be shortened. (2) Apparatus for winding thread packages tapered at each end comprises a rotating roller, a thread guide carried at one end of an arm to the other end of which is fastened a rod that passes through a slot in a lever pivoted to a traverse rail by which it is oscillated about a fulcrum, whereby the arm is reciprocated along an axis parallel with the roller and swings about the axis as the package fills, thereby moving the rod in the slot nearer to the fulcrum of the lever so that the traverse of the thread guide is shortened. Both inventions may be applied to machines in which the thread is wound on a roller forming a package which is rotated by contact with a driven drum, or to winding apparatus in which the thread is collected directly on a roller through the centre of which passes the driving shaft. C.

**Hank Reel.** W. Gibson. B.P. 560,863 of 20/3/1942:25/4/1944. A reel or like machine for winding yarn into a hank consisting of close side by side windings and which comprises or is adapted to receive a swift or equivalent rotary member for the yarn, is provided with yarn guide and drag means to prevent whipping of the yarns passing to the swift so that they are closely and accurately laid side by side on the swift, and means whereby the windings are automatically sub-divided into cuts as they are wound. The dividing means comprise cross-members each having a sharp dividing edge presented outwardly and spaced along the swift to constitute notches or recesses of such width as to receive the predetermined number of windings constituting a cut, each notch having a yarn-supporting surface offset from the corresponding surface in the

adjacent notches to cause adjacent cuts or groups of windings to lie in different planes or be offset to facilitate leasing or tying them into hanks. Preferably the yarn guide and drag means comprise yarn guides offset in the direction of traverse from the yarn bobbins so that the yarns bend round the guide means in passing from the bobbins to the swift and a drag arrangement for each bobbin. C.

**Hank Winding Reel.** W. Gibson. B.P.560,890 of 20/3/1942:25/4/1944. A reel or like machine for winding yarn into hanks, which comprise a number of cuts preferably adapted to be leased or tied together in one operation at the conclusion of the winding of the hank, by a continuous relative traverse between a swift, which preferably has means for dividing the yarn into cuts as they are wound, and yarn-guiding means, comprises traversing means driven from the swift-driving shaft and including a rotary traverse wheel which makes several complete revolutions in the course of winding a hank and separable toothed members driven by the traverse wheel and of which the tooth pitch or spacing is such as to correspond to a traverse movement equivalent to a substantial number of windings, a clutch between the swift-driving shaft and a primary driving shaft, clutch-operating mechanism, manual control means for the mechanism and automatic stop means for controlling the mechanism including an element held inoperative by a part traversing with the yarn-guiding means until the traverse wheel has commenced its last revolution and further held inoperative by a support rotating with the traverse wheel only until the latter has completed its last revolution when the element is freed to cause disengagement of the clutch when the hank has exactly been completed. Preferably the clutch-operating mechanism comprises pivotally related members adapted respectively to be on opposite sides of a dead centre position when the clutch is engaged or disengaged and spring means adapted automatically to hold the members in either of the positions, and preferably the manual means comprise a hand rod extending along above the supply bobbins and yarn guiding means. C.

**Loom Beat-up Mechanism.** Brough, Nicholson & Hall Ltd. and H. Pegg. B.P. 560,993 of 26/10/1942:1/5/1944. A loom is provided with a reed that includes an upper section disposed vertically in the warp shed in its retracted position, a lower vertical beat-up section located considerably in advance of the upper section and disposed below the warp shed in proximity to the fell of the cloth, an intermediate section extending between and connecting the upper and beat-up sections, and means to reciprocate the reed in a movement having vertical and horizontal components so that the reed is lifted bodily through the warp shed to bring the lower beat-up section into alignment with the warp shed and then undergoes a limited horizontal beat-up movement. The reed may be mounted to pivot about an axis adjacent the beat-up section and the upper and beat-up sections may be disposed at an angle to one another such that the upper section lies on an arc or chord of a circle described about the axis, and interconnected by an intermediate section extending parallel to the general direction of the warp shed in the retracted position of the reed, means being provided to oscillate the reed angularly from a position wherein the upper reed section lies in a plane at right angles to the general direction of the warp to a beat-up position in which the beat-up section is disposed vertically. The reed wires in the intermediate forwardly projecting section are preferably arranged so that alternate wires are located in different planes thus providing a greater interval between adjacent wires. This increased spacing provides improved facilities for the passage of yarn defects and in conjunction with the reduced beat-up movement results in a considerable reduction in the friction or abrasion between the reed and the warp threads. Means may be provided to ensure the weft thread being carried forward to a position in front of the beat-up section of the reed before the reed undergoes its vertical movement. C.

**Straight-bar Knitting Machine Thread Carrier Mechanism.** G. Blackburn & Sons Ltd. and H. W. and E. Start. B.P.561,082 and 561,103 of 29/8/1942:4/5/1944. (1) In thread carrier mechanism, particularly plating mechanism which will permit of plated or spliced work being produced with the machine running at the same speed as that used for the production of ordinary work, each of one or more of the thread carriers associated with each knitting head in the machine is connected to a member slidably

mounted on a reciprocating bar and positively driven thereby between end stops. The driving connection between the reciprocating bar and the driven member is arranged so that the driving connection is made when the thread carrier is disposed a predetermined distance in front of the slur cock and broken when the member engages with or is close to the end stops. Locking mechanism is provided to prevent rebound of the member when it engages with the end stops. (2) In thread carrier driving mechanism, particularly plating mechanism which will permit of plated or spliced work being produced with the machine running at a greater speed than that normally used for the production of this class of work, each of one or more of the thread carrier bars is connected to an associated member slidably mounted on a bar and positively reciprocated between end stops by a reciprocating bar. Each member is preferably mounted on the reciprocating bar and the driving connection between the reciprocating bar and the driven member is arranged so that it is made when the thread carriers are a predetermined distance in front of the slur cocks and broken when the members engage with or are close to their end stops. Locking mechanism is preferably provided to prevent rebound of a member when it engages with its end stops. C.

**Stocking with Separately-knitted Foot and Leg.** K. Allsop Ltd. and R. L. Carter. B.P.561,114 of 2/11/1942:5/5/1944. A stocking comprises a separately-knitted foot and leg, and a turnover top at the ankle, which three parts are permanently united by linking or seaming to form a single garment giving the appearance in wear of an ankle sock worn over a stocking. If the foot becomes worn or the leg is laddered it is possible to replace the damaged part of the stocking. The foot and the turnover top may be made in one and the leg, made without a foot, attached thereto or the three parts may be made separately. The turnover top is preferably ribbed. C.

**Knitting Machine Sinkers.** Scott and Williams Inc. U.S.P.2,333,667. Each sinker of a knitting machine with independently movable latch needles and sinkers comprises a ledge for holding yarn during the drawing of loops, a hook behind the ledge to provide a throat for holding yarn during the movements that free the latches of loops, and a butt behind the hook for the cam actuation of the sinker. C.

**Triethanolamine Ester Cellulose Acetate Yarn Dressing Agent.** Eastman Kodak Co. U.S.P.2,333,770. A lubricating and softening agent for cellulose acetate yarn contains as essential ingredient triethanolamine mono-acetate di-propionate. C.

**Multiple-box Loom Wrong Weft Excluder.** A. S. Dawkins and J. A. McFalls (Rockingham, N.C.). U.S.P.2,333,846. The claim is for a device to prevent weft from idle shuttles from being jerked into the shed. The cams that actuate the shuttle boxes also carry lifting bars and wires to lift the idle wefts out of the way. C.

**Elastic Selvedge for Knitted Fabric: Construction.** Hemphill Co. U.S.P. 2,333,870. Elastic yarn is knitted into alternate loops of the fabric under such tension that on release it will bind the stitches to form a non-ravelling edge. C.

**Elastic Stocking Top: Construction.** Hemphill Co. U.S.P.2,333,882. An elastic yarn is fed to alternate needles of a series at one feed of a plain multi-feed machine, then a plain yarn is immediately fed at a separate station, this plain yarn is knitted on all the needles so that the elastic yarn is cast off to be held by sinker wales of an initial course, then the elastic yarn is fed to the hooks of all the needles, but knitted on alternate needles only and tucked on the others, and plain yarn is finally knitted through the knitted and tucked elastic stitches. C.

**Knitting Machine Fabric Take-up Mechanism.** Hemphill Co. U.S.P.2,333,897. The rollers of the take-up mechanism are mounted on spindles so that they may move in parallel or angular relationship to and from each other through an extent sufficient to separate them entirely. C.

**Pick-and-Pick Loom Weft-replenishing Mechanism.** Crompton & Knowles Loom Works. U.S.P.2,333,904. A loom operating with a number of shuttles for plain weft and one for distinctive weft, reserve wefts being supplied from a magazine, has a pair of shuttle boxes at the magazine end of the sley and a gang

of three shuttle boxes at the opposite end, one to serve as the home box for the distinctive weft. The boxes operate normally in 4-pick cycles, each for two successive picks, but means are provided to interrupt the normal cycle when the distinctive weft shuttle is to operate. Weft replenishment occurs while the boxes are inactive. C.

**Warp Knitting Machine Patterning Mechanism.** Rudolph Bassist and others. U.S.P.2,334,058. The machine has a pattern-actuated cam shaft for operating the needles and yarn guide bar and for imposing on the warp beam a fluctuating component of movement corresponding with the fluctuating demands for yarn by the intermittently-moving guide bar. C.

**Knitting Machine Adjustable Draw Cam.** George W. Borg Corporation, U.S.P.2,334,353. The claim is for latch means for the alternative positioning of the draw cam for loose stitch or tight stitch control. C.

**Shuttle Spindle.** Draper Corporation. U.S.P.2,334,675. The claim is for a pivoted spindle and means, comprising a spring, a cam-surfaced abutment and a stop, for holding the spindle in its working position in the shuttle. C.

## 4—CHEMICAL AND FINISHING PROCESSES

### (A)—PREPARATORY PROCESSES

**Wetting Agents and Detergents: Volumetric Determination.** J. M. Preston. *Chemistry and Industry*, 1944, 176-177. In a method of volumetric analysis which is applicable to wetting agents and detergents, an anion-active solution is generally titrated with a cation-active solution, but the method is not limited to the case where both ions are surface active. As the titration proceeds, the surface active ions mutually precipitate one another and the end point is shown by a sharply-defined maximum surface tension. During the titration the surface tension is followed by observing the pressure that is required to force a slow stream of air bubbles at a constant rate through the solution in the titration vessel. With some pairs of cation- and anion-active substances the change of pressure at the end point is as great as 25 per cent. of the total pressure, which includes the hydrostatic pressure. The pressure is measured by an inclined tube manometer with a magnification of 20. Working in suitable concentrations, changes of the manometer of 1 to 4 cm. are observed at the end point for the addition of 0.1 c.c. to a total volume of about 40 c.c. Solutions of surface-active substances, such as branched and straight chain alkyl sulphates containing about  $C_{18}$ , oleic acid and sulphated castor oil soaps, and cetyl pyridinium and cetyl trimethyl ammonium bromides, give satisfactory results at concentrations of about M/1000. Comparison of the results of analyses by the new method with those obtained by other methods are satisfactory. C.

### (B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Rayon Crêpes and Staple Fibre Fabrics: Processing.** J. Chadwick & Co. Ltd. *J. Textile Inst.*, 1944, 35, P33-40. C.

**Scouring and Milling: Treatment of Felts and Flannels.** D. R. H. Williams. *Wool Rec.*, 1944, 65, 628, 631, 633. The characteristics of the Williams-Peace combined scouring and milling machine, particularly the movable mouthpiece, have proved especially valuable in milling airplane tank felts, R.A.F. woollen weft serge and Morley flannel. Particulars are given of the milling of these three types of fabrics. W.

### (E)—DRYING AND CONDITIONING

**Porous Materials: Drying; Diffusion Phenomena.** E. F. M. van der Held. *Gesundh.-Ing.*, 1941, 64, 211-216 (through *Chem. Zentr.*, 1941, ii, 382 and *Chem. Abstr.*, 1944, 38, 1159<sup>7</sup>). A differential equation is derived for diffusion at constant and variable temperatures in a gas, and applied for the case of evaporation from a surface. The analogy to conduction of heat is used. For diffusion in porous materials a modified diffusion factor is assumed, derived from that for the diffusion of two gases into one another by multiplication with the pore surface per unit area, and division by the mean length of the canals between two parallel surfaces at a distance of 1 m. C.

## (G)—BLEACHING

**"Blankophor" White Fluorescing Substances: Application to Bleached Materials.** R. Michel. *Färber u. Chemischreiniger*, 1942, 110-111 (through *Chem. Zentr.*, 1943, i, 2550 and *Chem. Abstr.*, 1944, 38, 1119<sup>5</sup>). The customary bluing can be replaced by optical methods, especially the application of white fluorescing substances, the Blankophors (I.G. Farbenindustrie). Blankophor B is suitable for bleached cotton, semi-bleached linen and slightly bleached or unbleached staple fibre and rayon; it gives a bluish white tint. Blankophor R gives a violet-white tint. Blankophor WT is suitable for animal fibres. Recipes and applications are discussed. C.

**Sulphite Pulp: Bleaching; Effect of pH.** I. S. Khutorschikov. *Bumazhnaya Prom.*, 1940, No. 11, 24-28 (through *Khim. Referat. Zhur.*, 1941, No. 7-8, 118 and *Chem. Abstr.*, 1944, 38, 1109<sup>6</sup>). The content of  $\alpha$ -cellulose of sulphite pulp and the viscosity in cuprammonium are lowest when the pH of the bleaching solution is 6-7. The amount of chlorine used is smallest at pH 9.5. The time required for bleaching is shortest in neutral media. This is attributed to the greater stability of chlorolignin in an acid medium. C.

**Mechanical Pulp: Sodium Peroxide Bleaching.** J. S. Reichart. *Paper Trade J.*, 1944, 118, TAPPI, 89-96. The development of sodium peroxide bleaching of mechanical pulps is reviewed and details are given of the procedure, equipment, reagents, control tests, yields and costs. The process consists essentially of three steps: (1) rapid and thorough mixing of the sodium peroxide bleaching solution with the pulp in controlled proportions, (2) storing the treated pulp long enough to permit the bleaching to go to completion, and (3) mixing the bleached pulp with a neutralising and reducing agent. The effects of a number of variables, such as the type of wood, ageing of the pulp, quality of water, and bleaching conditions, are discussed. The results of preliminary work have shown that substantial increases in pulp brightness are obtainable with practically no weight loss at a cost well within economic limits. The bleached pulp retains most of the desirable characteristics of unbleached groundwood and some valuable new properties are developed in the bleaching treatment. The bleached pulp can be used in the manufacture of a wide range of papers. C.

**Peroxide Bleach Liquors; Action and Control of Metal Catalysts in —.** J. S. Reichert, D. J. Campbell and R. T. Mills. *Paper Trade J.*, 1944, 118, TAPPI, 125-128. Tests with solutions of hydrogen peroxide and sodium peroxide have shown that copper, iron and manganese accelerate peroxide decomposition; the effect is catalytic and varies with the pH of the peroxide solution. De-activation of these metal catalysts can be accomplished by the addition of agents that inhibit peroxide decomposition within pH ranges peculiar to each stabilizer. Stabilization over a wide pH range can be produced by the use of a mixture of sodium silicate and magnesium sulphate. C.

## (I)—DYEING

**Dyed and Printed Cotton Fabrics: Fastness to Washing.** See Section 5C.

**Acid and Basic Dye Compounds: Application.** *Silk and Rayon*, 1944, 18, 428, 443. The practice of "topping" direct cotton dyeings or acid wool dyeings with basic dyes suggests the possibility of applying compounds of direct or acid dyes and basic dyes, preformed by the dye maker. One scheme is to search for compounds that are soluble in organic solvents, though not in water, and reference is made to B.P.555,410 (Geigy & Co.) as an example. The basic dye may be replaced in part by organic bases. C.

**Autazol Chrome Dyes: Application.** C. Blau, Jr. *Färber u. Chemischreiniger*, 1941, 22-23 (through *Chem. Zentr.*, 1941, ii, 116 and *Chem. Abstr.*, 1944, 38, 1367<sup>9</sup>). Autazol chrome dyes dye wool, cotton and particularly staple fibre fast and uniformly in a neutral or faintly acid ammonium sulphate bath. Commercial products are Autazol Chrome Black R, BA and Autazol Chrome Navy Blue BRA. The dyeing is followed by diazotisation with nitrite and acid, rinsing with ammonia and after-treating with a chromium salt. The R grade needs to be after-treated only with Autazol Chrome Salt R. The addition of Leonil O, Igepon or Igepal to the bath increases the absorptive power of the woollen fibre. Colour shading can be effected with Sirius or diazo dyes or with Chrome



Oxan dyes, etc. Acetate rayon is not dyed; it must be treated with Cellitazol STN conc., or AZN and developer ONL. C.

**Cottonin: Dyeing.** F. Gund. *Kleppzig's Textil Z.*, 1943, 46, 143-147 (through *Chem. Zentr.*, 1943, ii, 276 and *Chem. Abstr.*, 1944, 38, 1369<sup>8</sup>). The manufacture and properties of cottonin are discussed. Since it is used chiefly for working clothing, army requirements, knapsack fabrics, etc., it is dyed chiefly with indanthrene, hydrone and sulphur dyes. With indanthrene dyes, the application of the temperature step process is recommended, together with dyes of the IW and IK series. For the piece goods dyeing of bread bag and soldiers' knapsack fabrics, certain dyes are needed which dye "dead" fabrics well, e.g. Indanthrene Khaki GG, Olive R, Yellow 3R and 3RT, and Brown 3GT. The pigment slop-padding process is the best dyeing method. In dyeing twills consisting of staple fibre 60 per cent. and cottonin 40 per cent. with Hydron Blue, cottonized hemp produced dyeings of poor washing fastness, whilst cottonized flax gave better results. The cause is the presence of shives in the cottonized hemp. C.

**Fine and Coarse Rayons: Dye Concentrations for Same Shade; Determination with a Nomogram.** F. Fothergill. *J. Soc. Dyers & Col.*, 1944, 60, 93-95. The reason why a fine-filament yarn requires more dye than a coarse filament yarn to make it appear the same shade is explained and it is shown that  $C_2/C_1 = \sqrt{D_1/D_2}$ , where  $C_1$  and  $C_2$  are the dye concentrations and  $D_1$  and  $D_2$  the filament deniers. A nomogram for facilitating calculations based on this relation is presented and its use is explained and illustrated by examples. The accuracy of the results is discussed. C.

**Glycerin: Textile Applications.** Georgia Leffingwell. *Textile Research*, 1944, 14, 69-73. A review of recent developments in the use of glycerin in dyeing and printing, in textile oils and lubricants, and in the production of alkyd resins for the coating and treatment of fabrics, for use in dyeing and printing, and for the production of protective coverings for supports, e.g. yarn supports used in package dyeing. C.

**Spun Rayon Fabrics: Dyeing.** K. Rickert. *Deut. Färber-Ztg.*, 1943, 79, 75-77 (through *Chem. Zentr.*, 1943, i, 2735 and *Chem. Abstr.*, 1944, 38, 1369<sup>5</sup>). Causes of streaky dyeing of spun rayon fabrics are discussed. Decreased dye absorption can be caused by increased longitudinal orientation and increased density of the micelles. Viscose staple fibre contains a distinct fibre coat around a soft kernel; this is absent in Cu, Lanusa and Schwarza staple fibre. Dyeing experiments with 15 staple rayons, American cotton and German wool AB with Sirius Red 4B, Semiwool Fast Gray G and Sirius Light Green BB are reported. Delustred fibres consume more dye than non-delustred fibres; non-delustred staple fibre rendered hydrophobe behaves similarly to the ordinary delustred types. C.

**Winch Dyeing Machines and Washers: Application.** *Textile Weekly*, 1944, 33, 721-7, 830-4. A general account is given of the various types of winch dyeing and washing machines in common use, the choice of timber for winches, the efficient running of the machines, and variations imposed by the textile material under treatment. C.

**Cellulose Fibres: Dye Absorption.** D. Krüger. *Kleppzig's Textil Z.*, 1943, 46, 179-182 (through *Chem. Zentr.*, 1943, i, 2735 and *Chem. Abstr.*, 1944, 38, 1370<sup>3</sup>). The absorption of substantive dyes and the inner surface of cellulose materials, dyeing with base exchange and the dyeing of glass fibres are discussed. In the dyeing of cellulose fibres with substantive or with basic dyes, there are superimposed different reactions, due partly to differences in the inner structure and chemical composition of the fibre and partly to the properties of the dye molecule, of such a nature that it is impossible to determine accurately the inner surface of the fibre or the active groups of the cellulose molecule by this method. C.

**Dyes: Polymorphism.** I. Riskin. *J. Applied Chem. (U.S.S.R.)*, 1943, 16, 201-205 (through *Chem. Abstr.*, 1944, 38, 1367<sup>9</sup>). The dyes Red B and Hansa Yellow 3R (I.G. Farbenindustrie) can form two crystalline modifications, depending upon the solvents used. The form obtained from toluene is believed to be the principal form, whilst the second form, obtainable from pyridine solution, is believed to be secondary. The crystals have lighter colour in the second modification. C.



**Camouflage Textiles: Infra-red Reflectance.** E. I. Stearns. *Amer. Dyes. Rept.*, 1944, 33, 131-136. The importance of infra-red reflectance is discussed and it is pointed out that to offer good concealment a camouflage sample must match the surrounding natural colours not only visually, but also by infra-red photography. By a study of examples it is shown how the degree of detectability of any camouflage under visual observation or by the conventional infra-red photographs can be deduced. Camouflage specification tests, dyeing problems, photographic tests using Eastman infra-red film and Wratten light filters, and the interpretation of spectrophotometric data by the ten selected ordinate method are discussed. C.

**Dyeing Hair.** *Dyer*, 1944, 91, 13-14, 55-57, 93-94. Methods are given for dyeing mohair, alpaca, camel hair, horsehair, cow hair (including needle felt), goat hair and human hair. Methods are also recommended for stripping mohair and human hair. W.

#### (K)—FINISHING

**Spun Rayon Fabrics: Finishing with Formaldehyde and Resins.** W. Gutmann. *Kleppzig's Textil-Z.*, 1943, 46, 49-51 (through *Chem. Zentr.*, 1943, i, 2464 and *Chem. Abstr.*, 1944, 38, 1120<sup>1</sup>). The high swelling power of cellulose can be decreased by blocking the hydroxyl groups with formaldehyde or by introducing urea-formaldehyde resins into the fibre. The formation of dimethylolurea (I.G. Farbenindustrie's Kaurit KF) from urea and formaldehyde is described. The polymerisation of Kaurit KF in the presence of acid catalysts takes place best at temperatures of 115° or higher. The principal advantage of the use of Kaurit is improved creaseproofness, whilst treatment with formaldehyde improves washing resistance. The proper management of formaldehyde treatment is described. An organic formaldehyde carrier, e.g. Kaurit WF 110, makes it possible to improve the wet strength and to lower the swelling power. The technique of Kaurit application is discussed and the fixation of the following finishing agents with Kaurit WF is described: starch, Tylose TWA, Appretan EM, Na, WL, D, Persistol KF, Soromin BS, FL, SG, FFAN, AM and Ramasit S. C.

**Spun Rayon Fabrics: Swelling-proof Finish.** F. Haberl. *Deut. Textilwirt.*, 1943, 10, No. 3-4, 28-29 (through *Chem. Zentr.*, 1943, i, 2651 and *Chem. Zentr.*, 1944, 38, 1120<sup>4</sup>). The occurrence and the effect of swelling, treatment with urea resin and formaldehyde, and the changes caused by this treatment are discussed. The diminution in swelling of the finished fabric should not exceed 40 per cent. of the original value, the decrease in elongation in the dry state should not be more than 25 per cent. of that of the untreated goods and the residual shrinkage of warp and weft should be 3.5 per cent., as determined by the method of the Staatliche Materialprüfungsamts, Berlin-Dahlem. C.

**New Aliphatic Compounds: Properties and Uses.** H. B. McClure. *Chem. and Eng. News*, 1944, 22, 416-421. Aliphatic compounds which have recently become available in quantity commercially, including alcohols, Ethylbutyl Cellosolve, glycols, ethylhexanediol (mosquito repellent), water-soluble waxes and lubricants, pharmaceutical bases, water-soluble glycol-cellulose films, products for increasing the wet strength of paper, glyoxal, ketones, isophorone, various esters such as Flexol plasticizer DOP, ethyl silicate and Tergitol, various amines, amine-fatty acid condensation products, sulphur compounds and chlorinated compounds, are reviewed and their industrial uses are outlined. A table summarizes the physical properties. C.

**Plastics: Manufacture and Uses.** *Silk and Rayon*, 1943, 17, 166-8, 304-6, 442-4, 455, 705-6; 1944, 18, 216-8, 537. A popular account is given of the chemistry of plastics. The chapters deal with various uses, phenol-formaldehyde resins, and urea-formaldehyde resins. C.

**Wool-like Acetate Rayon: Production.** A. Wylezich. *Zellwolle, Kunstseide, Seide*, 1943, 48, 64-68 (through *Chem. Zentr.*, 1943, i, 2745 and *Chem. Abstr.*, 1944, 38, 1371<sup>9</sup>). Treating acetate rayon with water at 70-100° and with soap, Gardinol, etc., produces curling. This can occur also during the degumming of mixtures of acetate rayon and silk. A number of experiments were made on the treatment of fabrics under tension by boiling, and addition of soap, Gardinol, urea, etc. Soap gave a softer, fuller feel than water alone. Dyeing gave good results at 60°, but not at 100°. C.

**Raising Machine: Operation.** *Textile World*, 1944, 94, No. 3, 77, 82. A brief, illustrated account of the raising ("napping") process. In the United States, women operatives have proved to be capable machine tenders, with the foreman to make the adjustments, decide when the rollers need re-clothing and supervise oiling and greasing. C.

**Rayon Stockings: Finishing.** *Silk and Rayon*, 1944, 18, 551-552. A brief discussion of the respective methods of (1) the steam press and (2) continuous passage on the "shapes" through steaming, drying and conditioning chambers, for finishing rayon stockings. The former method usually makes the stocking  $\frac{1}{2}$ -1 inch longer in the leg, elongates the stitches, with consequent modification of the lustre, and has a polishing effect. At present, the appearance secured by the continuous process is preferred. C.

**Softening Agent Atomizing Installations.** R. Hünlich. *Deut. Textilwirts.*, 1941, 8, No. 5, 6-8 (through *Chem. Zentr.*, 1941, ii, 129 and *Chem. Abstr.*, 1944, 38, 1373<sup>1</sup>). Two-, three-, and four-cylinder MAKHA high-pressure installations are described in which the softening agents are atomized to such an extent that the fibres become uniformly moist and pliable. For scientific investigation of the softening process a special installation was built in which the number of rotations of the high-pressure pump could be varied continuously between 300 and 900. C.

**Laboratory Ink.** M. Burger. *Canadian J. Med. Technol.*, 1943, 5, 113 (through *Biol. Abs.*, 1944, B, 18, 2772). Ink for marking fabrics is composed of silver nitrate, 30; aerosol (10 per cent. solution), 1; blue-black writing ink, 1; gum arabic, 0.5, and water to make 100. Marks should be briefly exposed to ammonia. Other uses are for marking labels before autoclaving, and for glass-ware; in the latter case the mark is heated to dull redness. W.

#### (L)—PROOFING

**Cellulose Acetate-Wool Military Fabrics: Finishing.** F. Deshayes. *Teintex*, 1941, 6, 69-70 (through *Chem. Zentr.*, 1941, ii, 291 and *Chem. Abstr.*, 1944, 38, 1119<sup>3</sup>). Experiments were carried out with acetate staple fibre (Fibres N Rhodiacéta) which had been crimped, cut to lengths of 60 mm. and dyed. Because of their smoothness, the acetate fibres were not oiled but were added as such to the oiled wool. Strong alkalis should not be used in the fulling operation because of danger of saponifying the acetate fibres; the mixed material was steeped in a bath containing 8 g. ammonium hydroxide (22° Bé.) per l. The fat constituents of the wool furnish sufficient soap for the fulling. Washing is carried out with cold sodium carbonate and the fibres are waterproofed in the usual manner with aluminium chloride. C.

**Washing-resistant Water-repellent Finishes: Production.** K. Quehl. *Kleppzig's Textil-Z.*, 1943, 46, 114-117 (through *Chem. Zentr.*, 1943, i, 2651 and *Chem. Abstr.*, 1944, 38, 1120<sup>5</sup>). Methods of obtaining resistance to washing in water-repelling action are discussed critically, including the Velan process, the treatment of textiles with high-molecular isocyanates in non-aqueous solutions or aqueous emulsions, the use of casein or albumin and formaldehyde or salts, the Persistol process and Rotal impregnation. Resistance to washing may decrease slightly, especially after the third to the fifth washing, after which the effect becomes constant until the 25th and often the 50th washing. Reasons for this loss of fastness are improper concentration of liquids used, deviations from the proper impregnation technique, incorrect bath temperatures and compositions, insufficient drying of the goods after the treatment, etc. C.

**Chlorinated Phenols: Use as Preservatives and Disinfectants.** W. H. Stevens. *Chemistry and Industry*, 1944, 176. Chlorophenols are used for the preservation of wood, leather, cellulosic products, textiles, proteins, starches, adhesives, rubber latices, oils and paints, to prevent insect attack on wood, and for the control of slimes and algae in various industries, particularly those using closed cooling water systems. Pentachlorophenol, or its sodium salt, is generally used on account of its high efficiency and economy in use. *p*-Chloro-*m*-cresol is widely used for the preservation of proteins, gums, adhesives, etc., whilst for the lowest cost tar acids are employed. In some compositions, such as distempers, no great superiority has been established for chlorinated phenols over ordinary cresylic acids and it is thought that the drying oil or pigment in some way interferes with the preservation of the casein or glue by the chlorinated bodies.

cellulose sheet showed that under constant temperature and humidity conditions the air transmission rate varied with the thickness of the sheet. Increase in temperature increased the transmission rate, whilst increase of humidity reduced the rate. With regenerated cellulose, increase of humidity increased the rate of transmission. The amount of air transmitted in tests on vinylidene chloride and polyvinyl alcohol sheets during a 17-hour period was not perceptible. C.

#### PATENT

**Constant-rate-of-loading Testing Machine.** S. Denison & Sons, Ltd., H. M. H. Denison and A. Lenton. B.P.560,832 of 30/9/1942:21/4/1944. A testing machine comprises means for co-ordinating the stresses applied to the specimen with the rate of loading or counterbalancing of a steelyard on which is in part traversably mounted an adjustable poise-weight, the poise-weight also being in part mounted on and traversable along a fixed track disposed substantially parallel to the longitudinal centre line of the steelyard. The poise-weight is adjustably mounted on a trolley, the trolley being provided with a wheel bearing on the steelyard and a wheel bearing on the fixed track whereby the counterbalancing force is imparted to the fore part or front axle of the trolley. The steelyard is connected with a loading lever associated with the specimen through the medium of an intermediate lever having connection to an automatic load indicating mechanism. The angular motion of the steelyard under load applying conditions is used to control the speed of traverse of the specimen anchorage. C.

### 7—LAUNDERING AND DRY CLEANING

#### (A)—CLEANING

**Egg Albumin-Detergent Complex: Structure.** K. J. Palmer. *J. Phys. Chem.*, 1944, 48, 12-21. A structure for a denatured egg albumin-detergent (Nacconol NRSF) complex is postulated which appears to be in agreement with the results of an electrophoretic investigation of this system by Lundgren, Elam and O'Connell. It consists of a polar protein monolayer with the detergent molecules adsorbed on one side only and with the long axes of the detergent molecules perpendicular to the protein layer. From this structure it is suggested that the polar amino acids probably alternate along the peptide chain in egg albumin. It follows that if the layer structure for native egg albumin postulated by Pauling is acceptable, the layers in the native configuration are polar. By use of this model a plausible structure is postulated for the complex which forms between native egg albumin and detergent. This structure appears to account for the observed facts that the complex formed from native egg albumin never contains less than 25 per cent. of Nacconol NRSF (whereas that formed from denatured egg albumin does), and that the complex containing 75 per cent. native egg albumin and 25 per cent. detergent can exist in equilibrium with free native protein. C.

**Soap Suspensions in Mineral Oil: Sedimentation Volumes and Rigidity.** W. Gallay and I. E. Puddington. *Canadian J. Res.*, 1944, 22, B, 16-20. The equilibrium sedimentation volumes of sodium soaps in suspension in mineral oils volume increase greatly with decrease in viscosity index of the oil. Flow/pressure relations, determined with a torsional viscometer, show that suspensions with large sedimentation volumes possess rigidity, whereas the flow is Newtonian in suspensions having small sedimentation volumes. Variation in sedimentation volume is therefore caused by difference in the tendency toward agglomeration or attraction between particles, leading to the formation of branched chains and scaffolding structures, with consequently greater sedimentation volumes. C.

**Trichloroethylene: Vapour Pressure.** H. J. McDonald. *J. Phys. Chem.*, 1944, 48, 47-50. Determinations of the vapour pressure of trichloroethylene in the range 18-86° C. are described and the results tabulated. The vapour pressure-temperature relation is expressed in the form of an equation. The heat of vaporization at the boiling point (87.19° C.) and 1 atm. pressure is found to be 7,679 cal. per mole, with an estimated mean error of  $\pm 100$  cal. Equations are given for the variation of density and refractive index with temperature. C.

**Dyed and Printed Cotton Fabrics: Fastness to Washing.** See Section 5C.

## PATENTS.

**Improvements in Detergent Compositions and Methods of Production.** F. D. Snell. B.P.561,294. Conv. (U.S.) 30/12/41. Appl. 4/6/42. Acc. 15/5/44. The invention comprises a detergent composition, including a water-soluble, ionisable, anionic surface-active compound, stable in alkaline solution, and a material containing sodium oxide and boron trioxide, whether fully combined or not. An example is composed of a water-soluble soap and sodium metaborate, and variation includes a calcium sequestration agent. Tests have been made in a launderometer and considerable increase in brightness, due to the addition of a borate material according to the invention was noted, even when the soap to which the detergent was compared was of a higher pH value. La.

**Improvements in Laundry Ironing Machines.** (1) D. & J. Tullis, Ltd. and R. Wilson. B.P.561,268. Appl. 6/10/42. Acc. 12/5/44. (2) I. M. Fisher. B.P.561,371. Appl. 14/10/42. Acc. 17/5/44. (1) The ironing machine consists of a stationary bed made up from a series of hollow box-like members arranged to form a plane continuous ironing surface, which can be internally heated. An endless conveyor band is mounted above the bed so that articles to be ironed are carried along in contact with the bed and are discharged from the other end of the machine. A number of padded float-irons or platens are fitted to apply suitable ironing pressure. (2) The ironing machine is designed particularly for the ironing of small articles such as handkerchiefs. A padded roller is provided, of the type commonly provided in power ironing machines, and this is adapted to be driven intermittently by a pedal or by the operator. Above, there is a clamping member, such as a polished bar, which can be mechanically raised or lowered as required. This clamp holds the handkerchief or other article straight until it passes between the rollers and the heated bed. The machine is then stopped automatically or by a pedal and another handkerchief is clamped on to the roller and the machine is restarted. It is claimed that by this means the handkerchief is less liable to crease and that, due to the periods of rest afforded to the roller, a greater rate of feed may be effected than is possible with a machine that is equipped with a continuously rotating roller of the same diameter and construction. The clamp may also constitute a safety guard for the fingers of the operator. La.

## 8—BUILDING AND ENGINEERING

## (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Glass Fibre Distillation Column Packing Material: Application.** G. W. Minard, J. H. Koffolt and J. R. Withrow. *Trans. Amer. Inst. Chem. Engrs.*, 1943, 39, 813-851 (through *Chem. Abstr.*, 1944, 38, 897<sup>9</sup>). This paper summarizes the results of some 600 tests of the use of glass fibre as a packing material for 1 ft. diameter columns. The work was done on a distillation column packed to a height of 6½ ft., and another packed to a height of 1½ ft. Data are reported for the concentration of aqueous solutions of ethyl alcohol, methyl alcohol and acetone. The effects of reflux ratio, vapour velocity and composition are summarized. The investigation indicates that glass fibre is characterised by (1) good rectifying performance, (2) high rate of throughput with low pressure drop, (3) low hold-up, (4) light weight per unit volume, (5) consistent behaviour, and (6) low cost. C.

**Cotton Sliver: Application in Marine Caulking.** J. L. Crane and S. Williams *Cotton (U.S.)*, 1944, 108, No. 2, 93-95. Because of the shortage of jute and hemp, the U.S. Navy authorities have made tests on the use of cotton sliver for caulking deck seams. Hitherto, cotton has been used for small boats and also in conjunction with oakum (hemp impregnated with pine tar and the like), but users have claimed that it tends to spring out of the seams before the glue is applied. To meet this difficulty, the tested materials included cotton sliver impregnated with castor oil, but this was not found satisfactory, partly because it clung to the caulking iron. The tests reported show, in fact, that plain cotton sliver is satisfactory as a caulking material, though a pound of it does not fill such a length of seam as a pound of standard oakum. It is recommended that the sliver should run 250 ft. to the pound and be supplied in reels, spools or balls. The desirable features of a caulking material are listed. They include low moisture absorption, and one of the tables of test data records regains after various periods at 70° F. and 65 or 100 per cent. R.H. C.

**"Mark 2 Black" Rust-proofing Agent.** Metal Processes Ltd. *Practical Engineering*, 1944, 9, 454-455. "Mark 2 Black" is a simple and quick process for imparting to iron and steel rust-resisting and abrasive-resisting qualities. The agent is supplied in powder form and gives a strongly alkaline solution. Except with articles having large dead flat surfaces, treatment is effected in mass in basket loads by immersing in the simmering solutions for some minutes, first in No. 1 tank (275-280° F.) and then in No. 2 tank (300-310° F.), afterwards swilling and drying off automatically in special hot oil. Details of the procedure are given. Articles should preferably be degreased before treatment. Any scale or oxide should be removed before treatment. The treatment is applicable to iron and steel, including wrought iron, malleable iron castings, or wrought iron cast steel, but not to grey iron castings or stainless steel and some high-duty steels. C.

**Masonite Hydrolysed Wood Products: Production.** R. M. Boehm. *Paper Trade J.*, 1944, 118, TAPPI, 109-112. The Masonite process consists of a steam explosion treatment in which wood chips are treated for a very short period with steam at a pressure of 1000 lb. per sq. in. The steamed chips leaving the gun are exploded into a brown, fluffy mass of moist fibre which may be formed into sheets and fed to hydraulic presses for the manufacture of insulation and pressed fibre products varying in specific gravity from 0.02 to 1.44. In the early stages of the steaming operation considerable quantities of acetic and formic acids are formed which produce acid hydrolysis. Hemicellulose is largely converted to a water-soluble or -dispersible condition and is removed by a washing operation. The lignin-carbohydrate bond is broken. The cellulose portion is not greatly changed. The lignin undergoes a considerable degree of depolymerisation so that it is activated and in a suitable condition for re-exerting its bonding powers when subjected to the proper conditions of moisture, temperature and pressure. The bonding effect is to a considerable extent thermosetting, resembling that of synthetic resins. A modification of the normal process, which involves initially converting the fibre to a semiplastic condition, has made possible the production of materials of great density and thickness suitable for the construction of dies for forming and cutting metal parts for aircraft. Other modifications have made possible the production of dense, strong and water-resistant panels and lofting board for use in aircraft and ship building industries, hardboard for the construction of fluorescent lighting reflectors, and formed articles such as ice boxes, chair seats and backs. C.

**Metallic Machine Components: Non-destructive Testing.** B. Chalmers. *Proc. Phys. Soc.*, 1944, 56, 132-147. Non-destructive indirect methods of measuring the dimensions of metallic components and non-destructive tests for flaws, tests of physical properties related to mechanical properties, and tests for surface protection and surface profile are reviewed. A report is given of a discussion in which further details of some of the methods were given. C.

**Plastic-impregnated Wood: Production and Properties.** L. Klein, H. Grinsfelder and S. D. Bailey. *Ind. Eng. Chem.*, 1944, 36, 252-256. Methods of improving the physical properties of wood involving (1) impregnation with phenolformaldehyde resin followed by compression, (2) application of heat and pressure to an assembly of veneers interleaved with resin film, and (3) application of liquid resin to veneers by resin glue spreaders, followed by the application of heat and pressure, are reviewed and their advantages and disadvantages compared. Data are presented showing the dimensional stability to water and heat, tensile strength, impact strength, ease of compression, shear strength, modulus of elasticity in bending, modulus of rupture, ease of manufacture, surface appearance, and cost of products of the three processes. It is pointed out that the choice of material will depend upon its intended use, and various fields of application are mentioned. C.

**Porous Non-ferrous Castings: Sealing.** Bakelite Ltd. *Practical Engineering*, 1944, 9, 458-459. The Bakelite sealing process has proved ideal for the treatment of inter-crystalline porosity in non-ferrous castings caused by high pouring temperatures, inadequate feeding, or the presence of gas. The sealing material is stable under the majority of service conditions and is unaffected by water, steam up to 205° C., oil up to 135° C., diethylene glycol, petrol and other organic solvents, and most chemical reagents except concentrated sulphuric

and nitric acids and hot caustic alkali. Before treatment the castings should be free from liquids used for previous pressure tests, e.g. water, paraffin or oil. All exits on the casting should be closed except those to be used for filling the casting with the sealing solution and removal of displaced air. When the casting is filled, pressure is applied by means of a hand pump or by the use of compressed air. The pressure applied should preferably be high enough to force the Bakelite solution through the porous area to the outside of the casting. The casting is then emptied and wiped, and placed in a well-ventilated stove. Heat is applied so that during the first hour the casting is brought up to a temperature of about 85° C. and held for one hour. After the solvents are removed the temperature is raised to about 110° C. for an hour and finally to 135-170° C. for a similar period to ensure complete polymerisation. Successful applications of this process to various types of castings are reported. C.

#### (B)—FIRE PREVENTION

**Softening Agents: Fire Hazard.** Metz and Borchert. *Arbeitsschutz*, 1941, 93-97 (through *Chem. Zentr.*, 1941, ii, 134 and *Chem. Abstr.*, 1944, 38, 1373<sup>3</sup>). The fire hazard of unsuitable softening agents is discussed. Poly-unsaturated fat acids are the principal cause of spontaneous ignition. Primary peroxides are produced, and these act as powerful oxidising agents with the evolution of heat to cause spontaneous ignition. Unsaturated acids can be detected by means of the iodine number. The difference between the iodine and the thiocyanogen numbers gives the amount of poly-unsaturated acids. The Mackey test is a measure of spontaneous ignition. Experiments on softeners showed the value of the Mackey test. Iron is an effective oxidation accelerator. Directions are given for the Mackey test and for iron determination. The determination of pH with the universal indicator "Merck" or with Lyphan paper is discussed. The influence of softeners on iron is described. Softeners approved by the Staatliche Prüfungsamt are listed. C.

#### (C)—STEAM RAISING AND POWER SUPPLY

**Steam and Water Piping: Maintenance.** F. D. Mosher. *Textile World*, 1944, 94, No. 3, 96-97. Practical advice is given on the inspection of piping, valves and traps, on locating leaks in pipe covering, on improving the drainage of piping, and on the value of welding for repairs. C.

**"Electrode" Steam Raising Plant: Advantages.** Messrs. Bastian and Allen Ltd. *Textile Mercury and Argus*, 1944, 110, 488. For many textile mills requiring up to about 3,000 lb. of steam per hour, an electric boiler may be an economical proposition. Boilers of the a.c. "electrode" type are available in units that evaporate 75-3,250 lb. of water per hour at gauge pressures up to 120 lb. per sq. in. The efficiency is 98 per cent. so that almost all the 3,412 B.Th.U.'s equivalent to one k.W.h. are available. The boilers are lagged with 2-in. magnesia-asbestos blocks encased in planished steel and range from 3 ft. 6 in. to 8 ft. 2 in. in height and 1 ft. 7 in. to 3 ft. 4 in. in diameter. C.

#### (D)—POWER TRANSMISSION

**Driving Shaft: Stresses; Graphical Solution.** G. A. Pickett. *Engineering*, 1944, 157, 361-362. A graphical method of analysis, dealing with loadings which lie wholly in two planes, which is only applicable to circular shafts, is explained and illustrated by a study of examples. C.

**Second-hand Electrical Machinery: Selection.** *Silk and Rayon*, 1944, 18, 561-562. Practical advice is given on points to check when purchasing second-hand motors and their control gear, including tests of the insulation. C.

**Lubricating Oils: Corrosive Effect.** G. W. Waters and H. D. Burnham. *Ind. Eng. Chem.*, 1944, 36, 263-271. The corrosive effect of oils on bearings is analysed into two types: "existent corrosivity" which occurs by virtue of the instantaneous chemical state of the lubricant, and "potential corrosivity" which occurs under conditions, representative of those of service, which lead to the simultaneous oxidation of the oil. Reference is made to apparatus for measuring potential corrosivity and details are given of an apparatus and procedure for measuring existent corrosivity. The effects upon both types of corrosivity of temperature, time, nature of oil, concentration of reactants, and physical factors of tests are studied, and data obtained in tests of various oils

on various metals and alloys are presented in tables and graphs. The effects of oils containing acids and the effects of addition of detergents are discussed. C.

**Wool Baling Machine.** F. D. Snyder. *Text. World*, 1943, 93, No. 12, 95. The operation is described and illustrated of an electric drive for a wool baling machine. A plunger is pushed against the wool in the bale with the same pressure each time the plunger is made to go down. Bales are filled within 3 per cent. of the same weight. W.

(E)—TRANSPORT

**Warp Beam Transport System.** F. A. Westbrook. *Textile World*, 1944, 94, No. 2, 114-115. Illustrations are given of an overhead tramrail system for handling (and weighing) beams in the warping and sizing department of an American mill. It is expected to pay for itself in about a year. C.

(G)—HEATING, VENTILATION AND HUMIDIFICATION

**Radiant and Inductive Heating Appliances: Industrial Applications.** L. J. C. Connell. *G.E.C. Journal*, 1944, 13, 10-32. The characteristics of the various methods of heating are discussed and radiation and convection methods are compared. Lamps used as sources of radiation are described and an account is given of applications of lamp heating for drying paints, coil varnishes and foundry moulds, accelerating the setting of adhesives, drying fabrics and curing coated and impregnated materials, softening plastics, and various other purposes. Sources of radiation operating at temperatures lower than that of the lamp filament are discussed. Capacity current heating, wherein the material to be heated is made the dielectric of a condenser, the plates of which are connected to a source of radio-frequency power, and its applications in the production of laminated wood and laminated plastic materials, the drying of rayon yarn, the pre-heating of plastic moulding materials, and the joining of thermo-plastic materials are described. Eddy current heating, which consists in the production of alternating currents in the material by exposing it to an alternating magnetic field and is particularly suitable for surface hardening operations, is discussed. C.

**Steam Chamber Thermocouple: Sealing.** S. Munday. *J. Sci. Instruments*, 1944, 21, 67. A method of sealing electrodes into a steam chamber in such a way that no leakage of steam past the wires or insulators takes place is described and shown diagrammatically. C.

**Fans: Selection.** B. B. Daly. *G.E.C. Journal*, 1944, 13, 33-40. A summary is given of the laws of fan operation, together with typical performance data for the more common types. It is shown that, whilst the prediction of fan performance is straightforward, the converse problem of selecting a fan for a given performance is soluble only by trial and error or by cumbersome and little used "specific speed" and allied methods. A description is then given of a method for the ready solution of both performance prediction and fan selection problems, which employs a logarithmically divided ground chart common to all types of fan and covering a wide range of air-flow, fan static pressure, diameter and speed, over which moves a sheet of transparent material (cursor) on which is drawn a curve characteristic of a particular family of fans. C.

**High-frequency Heating Apparatus: Applications in the Plastics Industry.** A. E. L. Jervis. *Electrical Review*, 1944, 134, 728-731. High-frequency power can be used (a) for drying materials such as paper, tobacco, clays, ceramic articles, and wood, (b) for partial pre-heating of mouldings and laminates, e.g. propeller blade blocks, and (c) for complete heating and curing of mouldings and laminates. Curves are given showing the saving of time in comparison with steam heating, and also the relationship of curing time to thickness of moulding with conventional and high-frequency pre-heating. Operating and equipment costs of high-frequency heating are discussed and some approximate estimates are given. C.

(H)—WATER PURIFICATION

**Alginates: Use for Water Softening.** Pinnington, Dawson & Wood, Ltd. *Chemistry and Industry*, 1944, 187-188. By the steady use of sodium alginate, hard scale, in some parts  $\frac{1}{4}$ -in. thick, has been removed from boiler tubes. The water used in this particular works is drawn from a well fed by a spring and is rather over the medium in both temporary and permanent hardness and con-



tains substantial quantities of dirt and organic matter. Sodium alginate combines with the calcium to form an insoluble globular mass, which in turn envelops other sediment and precipitates, giving a soft pasty sludge. Much of this sludge can be blown out of the boiler at regular intervals and it is possible to swill off the sludge from tubes with a hose pipe. C.

**Water Filtration Plant.** J. D. Joseph. *Textile Manufacturer*, 1944, 70, 176-179. An illustrated account is given of modern plant for filtering water for industrial purposes, combined with chemical treatment for removing colloidal matter, iron and manganese, and objectionable odour. C.

#### (I)—WASTE DISPOSAL

**Textile Waste Liquors: Effect on Sewage Disposal.** C. R. Hoover. *Public Works*, N.Y., 1942, 73, No. 11, 32 (through *Water Pollution Res. Summ. Current Lit.*, 1943, 16, 124). Investigations at Middletown, Conn., on the effect of industrial wastes on common methods of sewage disposal are described in a report to the State Water Commission of Connecticut. When a very toxic component had been removed, up to 10 per cent. of typical composite textile waste could be added to the sewage without seriously affecting digestion of sludge. Copper in sewage tends to become concentrated in the sludge; sludge from sewage containing 0.5 p.p.m. copper was found to contain over 100 p.p.m. copper and digestion was impaired. Copper in sewage is not always due to industrial wastes; it may be present as the result of treating reservoirs with copper sulphate or of using copper pipes in domestic hot-water equipment. When the concentration of copper in sewage exceeds 1 p.p.m. digestion of sludge is usually affected, but it is probable that harmful effects of concentrations up to 1.25 p.p.m. can be reduced by addition of small amounts of a soluble sulphide. Copper can be removed from acid waste waters by filters of scrap iron, and from alkaline waste waters by treatment with sodium or calcium sulphides followed by copperas. Chromates do not accumulate in the sludge nor interfere with digestion to the same extent as copper compounds, but when 200 p.p.m. precipitated chromium is present in sludge, the rate of digestion is noticeably reduced. When more than 1 p.p.m. chromium is present in sewage received at a sewage works, chromium should be removed at the source. C.

**Wool Scouring Liquor: Recovery of Potassium Carbonate and Conversion to Commercial Potassium Sulphate.** P. K. van der Merwe. *Onderstepoort J.*, 1943, 18, 321-326. Suint from South African wool contains some potassium sulphate derived from (1) a sulphate-containing ground and burned veldt ash contamination of the wool, (2) the dipping of sheep in sulphate-carrying waters. Potassium carbonate from wool scouring liquor was converted to potassium sulphate on a commercial scale by a simple cation exchange reaction, using natural gypsum as the source of sulphate. W.

**Lanolin.** E. S. Lower. *Manufacturing Chemist*, 1944, 15, 13-16, 35, 68-71. The various qualities of lanolin now obtainable on the British market are summarised. Its properties are discussed, and an average analysis given of various grades. Its uses and those of its derivatives are described in detail. W.

#### PATENT

**Viscosity Regulator.** A.-B. Aerotransport (Stockholm). B.P.561,122 of 30/11/1942: 5/5/1944 (Conv. 29/11/1941). A viscosity regulator for a flowing medium, e.g. lubricating oil in engines, in which a valve device which is controlled by the pressure differential which occurs across a friction channel inserted in the path of the medium and varies as a function of the viscosity of the medium, regulates the two branch currents of the medium flowing to and by-passing a heat exchanger respectively, or two mixture components delivered to a mixer, in such proportions that a predetermined viscosity of the medium is maintained after the branch currents or the components have been mixed is characterised in that a differential piston or equivalent means which is actuated in one direction by the pressure differential across the friction channel and serves for the control of the valve device is actuated in the opposite direction by the pressure differential across a restricted passage of short axial length connected in series with the friction channel, the latter pressure differential being a function of the velocity of the medium, but substantially independent of the viscosity, and that the areas of the piston subjected to the opposed pressure differentials of said passage are so proportioned that the pressure differential



across the latter substantially neutralizes the influence on the piston or the like of such variations in the pressure differential across the friction channel as depend on variations of the velocity of the medium. C.

## 9—PURE SCIENCE

**Iron: Colorimetric Determination.** J. H. Yoe and A. L. Jones. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 111-115. Disodium 1:2-dihydroxybenzene-3:5-disulphonate is a sensitive and stable reagent for the colorimetric determination of ferric iron. The preparation of reagent and buffer solutions and a recommended analytical procedure are described. The nature of the reaction and the chemical behaviour of the coloured ferric complexes, as revealed by visual and spectrophotometric studies, are discussed. The coloured complexes (red in alkaline medium, blue in acid) obey Beer's law over the useful range of iron concentrations. In alkaline solution ( $pH$  9 to 10), the reagent is sensitive to one part of iron in 200,000,000 parts of solution when observations are made in Nessler cylinders. In acid solution ( $pH$  3.5 to 4.5), the sensitivity is one part in 30,000,000. In tests of the reagent with 78 ions, only 7 produced coloured solutions; the reaction with Ti (yellow) was the most intense. Only ferric iron gave a blue or red solution. Copper produced a greenish yellow colour in alkaline solution. By utilising the red complex, which is completely stable in alkaline solution, iron may be determined in the presence of large amounts of fluoride, tartrate, oxalate, citrate, or phosphate. C.

**Cellulose Ester Plasticizers: Determination.** B. S. Biggs and R. H. Erickson. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 93-94. For the determination of plasticizer content, dry samples of 1 g. or less are placed in weighing bottles, 3 c.c. of acetylacetone are added to each, and the bottles are placed in a special vacuum still in which the temperature is maintained at 256° C. by boiling "Dowtherm." Heating is continued for 1½ hours. The loss in weight is due to plasticizer plus a slight decomposition of the cellulose ether. The latter is determined on a blank, but is usually so small and uniform that a fixed value may be assumed for it. Reproducible results have been obtained with samples of cellulose acetate and acetate-butyrate containing diethyl phthalate, dibutyl phthalate, dibutyl sebacate and butyl stearate. C.

**Dicarboxylic Amino Acids: Determination in Protein Hydrolysates.** R. K. Cannan. *J. Biol. Chem.*, 1944, 152, 401-410. The essential steps in procedures for the determination of glutamic and aspartic acids in protein hydrolysates are the adsorption of the acids from the hydrolysates by the basic resin, Amberlite IR-4, followed by their elution with hydrochloric acid. The solution obtained contains no more than traces of amino acids other than the dicarboxylic acids. From it, glutamic acid hydrochloride and copper aspartate may be crystallized directly in pure form. Results obtained in the analysis of egg albumin,  $\beta$ -lactoglobulin and edestin are compared with results obtained by other methods. C.

**Polymerised Drying and Semi-drying Oils: Analysis.** J. C. Cowan, L. B. Falkenburg and H. M. Teeter. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 90-92. Details are given of a procedure for the determination of polymers in a heat-bodied vegetable oil which involves conversion to the methyl esters, removal of unpolymerised esters by distillation at 5 to 10 mm., and fractionation of the polymerised products by distillation at 1 mm. or less. The refractive index of each fraction collected is plotted against the total per cent. distilled up to the mid-point of that fraction, and a smooth curve is drawn. The percentages of monomeride, intermediate, dimeride, and higher polymers are determined from the graph. Results are given for bodied soybean, linseed, perilla, and tung oils. C.

**Vegetable Matter: Nitrogen, Phosphorus and Potassium Determination.** B. Wolf. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 121-123. Rapid photometric methods for the determination of total N, P and K in plant materials are presented. The material is rapidly decomposed by means of sulphuric acid and hydrogen peroxide and separate portions of the digest are used for the three determinations. The analysis for N involves the use of Graves' reagent and caustic soda, that for P the use of ammonium molybdate and aminonaphtholsulphonic acid, and that for K the use of sodium cobaltinitrite and isopropyl alcohol. Photometer readings are taken with a Fisher electrophotometer using appropriate

filters. Concentrations are read from standard curves or charts. The results obtained are less accurate than those obtained by the methods of the Association of Official Agricultural Chemists but are sufficient for many routine purposes. C.

#### (E)—ORGANIC CHEMISTRY

**Cellulose Primary-valence Gels: Formation.** R. Signer and P. v. Tavel. *Helv. Chim. Acta*, 1943, 26, 1972-1978 (through *Chem. Abstr.*, 1944, 38, 9067). Highly methylated cellulose, existing as linear macromolecules in dilute chloroform solution, was treated with oxalyl chloride, with traces of tertiary base added to fix the liberated acid, so that a clear gel resulted. The rate of formation of such a gel was studied as a function of the concentration of the reactants and of the amount of base present. C.

**Limit Dextrins: Formation and Composition.** (1) B. Ortenblad and K. Myrback. (2) K. Myrback, B. Ortenblad and K. Ahlberg. (3) K. Myrback and B. Kihlberg. *Biochem. Z.*, 1943, 315, 233-239, 240-249, 250-258 (through *Chem. Abstr.*, 1944, 38, 9849). (1) Dextrinogen amylase acts in two phases: (a) dextrinization, and (b) saccharification, the former being 20-50 times more rapid than the latter. The rate of reaction falls off suddenly when about 16 per cent. splitting has been attained. The products of the first phase are  $\alpha$ -dextrins. The conclusion is therefore drawn that the splitting occurs only at certain bonds. Studies with the enzyme show that both glucose and maltose are formed in the hydrolysis of a specially prepared starch substrate. The glucose represents about 15 per cent. of the maltose, and the substrate concentration has scarcely any effect on the reaction. Experiments with  $\alpha$ -dextrin show that the hydrolysis starts as a very rapid reaction, but soon slows down greatly and, as in the case of starch, glucose is also formed (about 20 per cent.). The dextrinogen amylase, therefore, is a special type among the amylases. (2) Fractionation of non-fermentable products obtained from different starches with malt extract or taka-diastase shows that limit dextrins are always mixtures of saccharides of different chain length, especially hexa- and tetrasaccharides. It is suggested that tetra- and tri-saccharides may originate from hexasaccharides through the action of some special enzymes. (3) The phosphorus content of various starch limit dextrin fractions appears to decrease with decrease in molecular weight of the respective fractions, although experiments with glycerophosphate show that, except for pancreatin, every amylase preparation used has phosphatase activity. C.

**Starch: Two-component Structure.** B. Brimhall and R. M. Hixon. *Wallerstein Lab. Comm.*, 1943, 6, 95-100 (through *Brit. Chem. Abstr.*, 1944, A II, 39). Evidence supporting the two-component theory of starch structure is presented. Methods for separating amylose (straight chain) and amylopectin (branched chain) are outlined, and the properties of these components discussed, variations between starches of different origin being noted. C.

**Casein Hydrolysis Products: Characteristics.** T. Winnick. *J. Biol. Chem.*, 1944, 152, 465-473. A study was made of the partial hydrolysis products from the action on casein of the enzymes pepsin, trypsin, chymotrypsin, ficin, and papain. Following digestions with the proteases, the average non-protein molecules contained from 5 to 7 amino acid residues. Values for carboxyl nitrogen indicated that 1 to 3 per cent. of the total nitrogen was in the form of free amino acids. The ratios of carboxyl nitrogen to the amino nitrogen freed by complete acid hydrolysis indicated that from 1.5 to 4.5 per cent. of the total amino acids of casein was liberated by protease action. Percentages of amino and carboxyl nitrogen were not altered significantly by electro dialysis of the digestion products. Specific rotations and molecular weights of the electro dialysed products were determined. The further action of carboxypeptidase on protease digests of casein was studied and interpreted as the splitting of free amino acids from the ends of polypeptide chains. The initial products from short periods of protein digestion were compared with those from prolonged protease action. The specific rotations and ratios of amino to total nitrogen of the products did not differ significantly in the two cases, in agreement with the view that relatively few protein molecules are split rapidly in each time interval in enzymic hydrolysis. C.

**Proteins: Reaction with Formaldehyde.** K. H. Gustavson. *Kolloid Z.*, 1943, 103, 43-54 (through *Brit. Chem. Abstr.*, 1944, A II, 27). The tanning effect of formaldehyde on proteins is discussed. Fibrous proteins, e.g. collagen, are more easily studied than water-soluble proteins, since they have measurable properties altered by formaldehyde treatment. Properties studied are temperature of contraction, swelling in water, and degradation by trypsin. In dilute formaldehyde solutions irreversible formaldehyde fixation is due to the  $\epsilon$ -NH<sub>2</sub> groups of lysine in the pH range 5-8, and the NH<sub>2</sub> groups of arginine at pH greater than 8. In concentrated solutions secondary reactions occur. Formaldehyde combines with partly deaminated collagen freed from primary NH<sub>2</sub> groups, but does not have a tanning effect. Thus the formaldehyde attached to NH<sub>2</sub> groups of arginine residues does not stabilise collagen chains by cross-linking; tanning by formaldehyde results from formation of cross-linkings between  $\epsilon$ -NH<sub>2</sub> groups of lysine in neighbouring chains. In acid solutions native collagen shows a tanning effect at high formaldehyde concentration, but deaminated collagen is unchanged. Formaldehyde fixation is a slow reaction in this case. Formaldehyde is also taken up by peptide groups, but is not then involved in cross-linking and stabilising the structure. Formaldehyde is also effective in organic solvents. C.

**Laurylsulphonic Acid: Migration Data; Interpretation.** P. Van Rysselberghe. *J. Phys. Chem.*, 1944, 48, 62-65. Migration data obtained by E. L. McBain for laurylsulphonic acid in aqueous solution are shown to indicate the presence of rather large amounts of nearly neutral micelles with compensating migrations at concentrations above the maximum in the transference curve. Below the maximum the transference numbers are in excellent agreement with the values calculated on the basis of a previously calculated average micelle whose composition and size change continuously with concentration. C.

**Sodium Alcohol Sulphates: Surface Tension/Concentration Curves.** G. D. Miles and L. Shedlovsky. *J. Phys. Chem.*, 1944, 48, 57-62. The surface tension/concentration curve for pure sodium dodecyl sulphate which had been extracted with ether does not show any minimum, but a minimum is observed in the curve for the same product before the final extraction with ether. Addition of small proportions of dodecanol to the pure sodium dodecyl sulphate causes the appearance of a minimum in the curve. Addition of sodium hexadecyl sulphate has a similar effect. Similarly, pure ether-extracted sodium tridecane-2-sulphate gives a surface tension/concentration curve without a minimum, but minima are observed in the presence of small amounts of sodium pentadecane-2-sulphate or heptadecane-2-sulphate. These results indicate that minima may be produced by (1) the presence in the solution of two surface-active materials, one of which is only slightly soluble in water, and (2) the presence of two anionic surface-active electrolytes. The explanation of the observed effects is briefly discussed. C.

**Cupriethylene Diamine Cellulose Solutions: Viscosity.** R. S. Hatch. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 104-107. A method is described for the precise determination of cellulose viscosity with cupriethylene diamine as solvent. Measurements are made of the time of fall of a  $\frac{1}{16}$ -in. aluminium sphere through a distance of 18 cm. in a 1 per cent. solution. Details are given of the preparation of the cupriethylene diamine solution and the calibration of the viscosity tubes. The preparation and solution of pulp samples for precise determinations and for rapid determination for mill control purposes are described. C.

**Gelatin and Glues: Differentiation.** A. Steigmann. *J. Soc. Chem. Ind.*, 1944, 63, 96. Relatively small differences in the setting point and viscosity of gelatins and glues are greatly exaggerated by taking the setting point of cold urea-gelatin solutions, or by addition of Teepol or similar anionic detergent to gelatin or glue solutions. Teepol increases the viscosities of such solutions and magnifies the differences as shown by the standard methods. Urea in high concentrations, though preventing the formation of a gelatin gel, does not decrease, but rather increases the viscosity under standard conditions (6½ per cent. solution: 40°). A setting-time test using solutions containing urea and a viscosity test with solutions containing Teepol are described. Viscosity data are given for solutions of different grades of gelatin, with and without Teepol. C.

**Macromolecular Systems: Viscosity and Chemical Constitution.** H. Umstätter. *Kolloid Z.*, 1943, 103, 7-18 (through *Brit. Chem. Abstr.*, 1944, A I, 14). A viscosity-concentration function incorporating Staudinger's relation is derived thermodynamically, and the limits of its validity are examined. Macromolecules are non-rigid and can therefore absorb part of the energy of solvent molecules on collision. Such inelastic collisions result in the formation of a sheath of solvent molecules around the solute molecule; solvation is thus accounted for without assumption of any special forces. Determination of particle size is possible from the flow curve and viscosity-temperature function. Large molecules may rupture if the molecular cohesion between neighbouring chains is greater than the chain strength. There is thus an upper limit to molecular size above which molecules are mechanically unstable. C.

**Rubber Derivatives: Viscosity.** Hermann Staudinger and Hansjürgen Staudinger. *J. prakt. Chem.*, 1943, 162, 148 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, B:115.1). The  $K_m$  values ( $K_m = Z_n/P$ , where  $Z_n = \lim_{c \rightarrow 0} \eta_{sp}/c$  and  $P = M/G_m$  where  $M$  is the average molecular weight, determined osmotically and  $G_m$  is the basic molecular weight) have been determined for various derivatives of rubber, balata and similar materials. With squalene and its hexahydrochloride, which serve as models for the substances of lower molecular weight, the halogen derivative has a higher value of  $K_m$ . With the hydrochlorides of balata and rubber, the  $K_m$  values are lower than those for the corresponding hydrocarbons. Apparently, the long molecules of the polyprene are shortened by a cyclization reaction in which the chlorine content falls below the theoretical value for the hydrochloride. The  $K_m$  values of the ethylpolypranes are similar to those of the hydrochlorides or slightly higher, and less than those of the original hydrocarbons. It follows that the decrease in  $K_m$  values from the hydrocarbons to the hydrochlorides is not due to a greater degree of coiling of the molecule because of the reciprocal attraction of the chlorine atoms. The  $K_m$  value of bromobalata is of the same order of magnitude as that of the hydrochloride, apparently on account of the same chain-shortening cyclization reaction. The  $K_m$  value of chloroprene is of similar magnitude to that of rubber, balata and Buna. This is further proof that the lower  $K_m$  values of polyprene hydrochloride cannot depend upon a coiling of the long molecules occasioned by mutual attraction of the chlorine atoms, but must be conditioned by a cyclization. In spite of the low viscosity of their solutions, the chlorinated rubbers have a very high molecular weight. Therefore, since chlorinated rubber, chlorinated balata, and chlorinated Buna are not decomposed by the chlorination process, the low viscosity of their solutions can only be explained by the assumption of a cyclization reaction which produces a marked shortening of the molecule. The  $K_m$  values of the chlorinated products are only about one-fifth those of the original rubbers and therefore a very considerable shortening of the chain must occur. This may be explained by postulating for the macromolecules of rubber, balata and Buna, a branched configuration whereby the side chains may react with the main chain, thus producing a marked shortening of the molecules. C.

**Fatty Acids: Conjugation; Determination from Absorption Spectra.** W. R. Brode, J. W. Patterson, J. B. Brown and J. Frankel. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 77-80. A method of determining the amount of 2-, 3- and 4-double bond conjugation in the presence of non-conjugated fatty acids by means of absorption spectra is explained and the application of the method to the analysis of samples of linoleic acid is described. The results indicate that the crystallisation method of purification gives products of lower total conjugation than those obtained by debromination of the tetrabromide. The conjugation rearrangement is probably caused by the zinc bromide formed during the debromination. The amount of conjugation varies with the solvent used. C.

**Carcinogenic Hydrocarbons: Fluorescence.** J. A. Miller and C. A. Baumann. *Cancer Research*, 1943, 3, 223-229 (through *Brit. Chem. Abstr.*, 1944, A I, 28-29). The intensity of fluorescence in solution has been measured for seven hydrocarbons in 37 solvents. In most solvents fluorescence increases progressively in the order: naphthacene, 1:2:5:6-dibenzanthracene, 1:2-benzanthracene, anthracene, 9:10-dimethyl-1:2-benzanthracene, 20-methylcholanthrene, 3:4-benzpyrene. Fluorescence is most intense in tetrahydrofurfuryl

alcohol, pyridine, glycol monomethyl ether, and dioxan; it is low in the lower alkanes, and zero in carbon disulphide or aniline. The fluorescence of these hydrocarbons, with the exception of 1:2:5:6-dibenzanthracene, is partly destroyed in solution by prolonged exposure to ultra-violet. Each hydrocarbon is stable to refluxing in 10 per cent. alcoholic potash for 1 hour. The most potent inhibitor of fluorescence is tetranitromethane. The inhibition is irreversible. The fluorescence of the unsaponifiable matter of mouse tissue has been measured in 18 solvents. The fluorescence is very weak as compared with that of the hydrocarbons and does not vary greatly with solvent. In mixtures it is strictly additive to the hydrocarbon fluorescence. C.

**Polynuclear Hydrocarbons: Fluorescence; Effect of Naphthacene.** J. A. Miller and C. A. Baumann. *Cancer Research*, 1943, 3, 217-222 (through *Brit. Chem. Abstr.*, 1944, A1, 28). Details are given for the purification of carcinogenic and related hydrocarbons, for the determination of fluorescence in liquid solution, and for the photography of the fluorescence spectra of these hydrocarbons in solution and in the solid state. Solid solutions (0.1 per cent.) of naphthacene in 3:4-benzpyrene, 20-methylcholanthrene, 9:10-dimethyl-1:2-benzanthracene, 1:2-benzanthracene, or in anthracene show fluorescence bands, which differ from those of either component and appear to be characteristic of the fluorescence of naphthacene in solid hydrocarbon solutions. The solid hydrocarbons and their solid solutions with naphthacene lose their ability to fluoresce on fusion in air or in a vacuum and regain it on resolidification. 3:4-Benzpyrene, when heated in liquid solution to its melting point retains its fluorescence. Naphthacene does not inhibit the fluorescence of liquid solutions of the hydrocarbons. C.

**Photo-electric Photometer: Instrument Setting Errors.** R. H. Hamilton. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 123-126. Mathematical and experimental proofs show that errors in settings of the galvanometer for zero and for incident illumination, and errors in reading the galvanometer deflection for transmitted light, produce high relative errors when a photo-electric photometer is used with solutions of high or of low absorption. For maximum accuracy, conditions should be so chosen that readings of transmitted illumination fall on the central portion of the scale. C.

**Trichromatic and Dichromatic Vision: Theory.** F. H. G. Pitt. *Proc. Roy. Soc.*, 1944, 132 B, 101-117. It is shown that if the dichromatic isocolour lines, plotted on any colour diagram of the usual type, are extended, they will either meet at a point which will represent a missing fundamental sensation, or they will be parallel to a line joining the points representing the two fundamental sensations which are fused. By using these properties it is further shown that protanopia is caused by the absence of the  $R'$  sensation, that tritanopia is caused by the absence of the  $B'$  sensations and that deuteranopia is caused by the  $R'$  and  $G'$  sensations being identical. The  $B'$  and  $R'$  points determined by these measurements and the  $G'$  point as determined by Walters, but slightly modified to suit the particular requirements set by the line  $R'G'$ , have been used to calculate the fundamental sensation curves. Luminosity, colour-mixture, and hue-discrimination data for both dichromatic and trichromatic observers, and to a less extent trichromatic adaptation and saturation data, are satisfactorily explained in terms of these response curves; such an explanation leads to the conclusion that the Young-Helmholtz theory of colour vision is fundamentally correct. The essential difference between the  $B'$  sensation and the  $G'$  and  $R'$  sensations is stressed. C.

**Circular-arc Cam with Flat Follower: Displacement, Velocity and Acceleration Curves.** W. Marsh. *Engineering*, 1944, 157, 362. A method of drawing curves showing the displacement, velocity and acceleration of the follower of a circular-arc cam with flat follower is explained, and acceleration and velocity curves are shown for the case of a circular-arc cam giving a rise and fall of 1 in. during 180° rotation. C.

**Plastics: Dielectric Properties and Use for Insulation.** T. Hazen. *Plastics Resins Ind.*, 1943, 1, May, 11 (through Mark & Proskauer's *Resins, Rubbers, Plastics, Abstr.*, 1943, A:814). The dielectric properties of polystyrene, phenolic cambric varnishes, resin-like or resin-containing liquid dielectrics, and

vinyl resins are discussed and some characteristic curves are given. Applications of these materials for electrical insulation are mentioned and limitations are indicated. C.

**Chain Polymers: X-Ray Structure.** C. S. Fuller and W. O. Baker. *J. Chem. Educ.*, 1943, 20, 3-10 (through *Brit. Chem. Abstr.*, 1944, A1, 5). X-Ray fibre patterns of polyethylene, polyisobutylene, polyvinyl alcohol, polyvinylidene chloride, several polyesters and polyamides, and cellulose triacetate are reproduced and discussed. C.

**Mass-produced Articles: Sampling for Quality Control.** W. Bartky. *Ann. Math. Statistics*, 1943, 14, 363-377. A multiple sampling procedure is proposed for controlling the acceptance of batches according to the percentage of defective units, in which a first sample is inspected, and on the basis of the results, either the batch is accepted, or it is rejected, or a second sample is taken. If a second sample is taken the procedure is then repeated on this and as many subsequent samples as are necessary to justify either acceptance or rejection of the batch. A few criteria for assessing the results of each sample are chosen and for these formulae are worked out for determining (a) the probabilities of accepting and rejecting various batches, and (b) the number of units tested per batch. C.

**Sodium Hypochlorite Solution: Use as Titrimetric Reagent.** N. I. Goldstone and M. B. Jacobs. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 206-207. Standard sodium hypochlorite solution is recommended as a general titrimetric reagent for micro-analytical work. The preparation of the solution and a procedure for standardisation with standard sodium arsenite or potassium antimonyl tartrate solution are described. The hypochlorite solution must be made with sufficient excess of sodium hydroxide so that the pH is about 12.5 and must be stored in brown, glass-stoppered bottles. Under these conditions, sodium hypochlorite solution is remarkably stable and compares favourably with other titrimetric reagents. Its advantages, compared with potassium bromate, for the micro-determination of antimony and arsenic are pointed out. C.

**Aluminium: Colorimetric Determination; Precision and Accuracy.** A. L. Olsen, E. A. Gee and V. McLendon. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 169-172. A colorimetric determination of Al (as  $\text{Al}_2\text{O}_3$ ) is described that involves the formation of the red complex with aurin tricarboxylic acid. The factors influencing colour intensities have been investigated and precision and accuracy studies have been made on typical analytical data. The average precision, measured by the average deviation of the single results from the mean, is about 1 per cent., whilst the over-all accuracy is about 1 to 3 per cent. C.

**Manganese: Determination.** J. I. Watters and I. M. Kolthoff. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 187-189. Details are given of experimental studies which show that vanadyl, vanadate, ceric, cerous, and chromic ions are quantitatively precipitated with an excess of ferric iron when hydrous ferric oxide is precipitated by pyridine. Chromate, however, divides between the precipitate and filtrate. The loss of chromium in this way can be prevented by the addition of a little sodium bisulphite solution. Manganous and ferrous ions remain quantitatively in the filtrate. The use of pyridine is advantageous in separating the interfering metals V, Cr, Ce, and a large excess of Fe from Mn prior to the polarographic determination of Mn as tri-dihydrogen pyrophosphatomanganate. C.

**Zinc: Determination.** P. J. Elving and J. C. Lamkin. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 194-198. A rapid control method for the determination of zinc in alloys comprises precipitation of Zn as the oxalate in aqueous acetic acid solution, centrifugal separation of the precipitate, dissolution in sulphuric acid, and titration of the oxalic acid with standard permanganate. Interfering effects of other elements and their removal are briefly discussed. Applications of the method to the determination of zinc in various alloys and concentrates are described. C.

**Phthalic Anhydride: Determination in Oil-modified Alkyd Resins.** C. D. Doyle. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 200. In a modification of the Kappelmeier method, the alcohol of crystallisation is removed from the precipitate obtained on hydrolysis of the alkyd resin with alcoholic potassium hydroxide by heating at 210° C. for one hour and the dipotassium phthalate is weighed. Results obtained for various resins by the standard and modified

procedures are compared. The data show that the modified procedure is applicable also to alkyd resins complicated by maleic anhydride or fumaric acid. C.

**Phthalic Anhydride: Determination in Oil-modified Alkyd Resins.** A. I. Goldberg. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 198-200. The Kappelmeier method for the determination of phthalic anhydride in oil-modified alkyd resins involves hydrolysis of the resin with alcoholic potash, which gives a precipitate of potassium phthalate containing one mole of alcohol of crystallisation. Disadvantages of the standard procedure are pointed out and modifications are suggested. Anhydrous potassium phthalate is recommended as the weighing form instead of the alcoholate. A simplified saponification procedure is described. The adverse effect of water and its elimination are discussed. A method is described for the titration of the dipotassium phthalate with perchloric acid in glacial acetic acid. C.

**Plant Samples: Grinding; Risk of Mineral Contamination.** S. L. Hood, R. Q. Parks and C. Hurwitz. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 202-205. An account is given of an investigation of the contamination of plant tissues resulting from grinding in common grinding mills and of the effects of the method of grinding, type of plant material, duration of grinding, and size of plant sample. Grinding in a Wiley mill and a hammer mill led to contamination by Fe and Cu. Jar mill grinding with flint balls resulted in contamination with Fe, Zn, Cu, Co and Na. The use of porcelain or Mullite balls during jar mill grinding gave rise to appreciable contamination with Fe, Zn, Cu, Co, Na, and in some cases Ca, S and P. Hand grinding with a mortar and pestle resulted in no appreciable contamination with Fe, Zn, Cu, B, Co, Mn, Mo, Ca, Na, Mg, P, S or K. Large increases in contamination with Zn, Fe, Cu, Co and Na resulted from decrease in size of plant samples ground in a jar mill using flint pebbles. For the types of mills studied, less contamination arose in the grinding of vetch seed than in the grinding of oat grain. The conclusion is drawn that marked errors would be involved in using the common mills for grinding plant tissue for general or extensive micro-analysis. C.

**Cellulose: Degradation with Inorganic Acids in the Presence of Acetic Acid.** A. Marschall and H. Stauch. *J. makromol. Chem.*, 1943, 1, 55-75 (through *Chem. Abstr.*, 1944, 38, 1353<sup>s</sup>). The raw materials for this investigation included two cotton linters [degree of polymerisation (D.P.) 863 and 1780], a rayon pulp (88 per cent.  $\alpha$ -cellulose, D.P. 897) and a refined pulp (96 per cent.  $\alpha$ -cellulose, D.P. 1080). These were treated with acetic acid containing 1, 2 and 4 per cent. sulphuric acid or 2 per cent. perchloric acid at 30 or 40° for 2, 4, 15 and 72 hours and examined for D.P. (nitrate method), alkali solubility, formic acid-zinc chloride solubility and  $\text{HSO}_3$  content. The combined  $\text{HSO}_3$  content was a maximum after the 2-hour period and after 72 hours had decreased about 25 per cent. The alkali solubility (compared at the same D.P.) did not increase in proportion with the sulphuric acid concentration and was greater for the sulphuric than the perchloric acid treatment (especially for the linters of lower D.P.). Alkali-solubility data are given also for aqueous acid (2N. sulphuric, 2N. perchloric and N. hydrochloric acid) treatment; in this case the perchloric acid gave higher solubility values (excepting for the linters with D.P. 1780). The yields of cellulose with 1 and 4 per cent. sulphuric acid in acetic acid were 87-95 per cent. after 2 hours and 62-76 per cent. after 72 hours; with the aqueous acids or with acetic acid alone, the yields were about 97 per cent. These differences are explained by the change in fibrous structure in sulphuric acid-acetate acid, the fibres being degraded to fragments (illustrated by photo-micrographs). Drying of the sulphuric acid-acetic acid treated material decreased the alkali solubility. A study is reported also of the glucose number of the above cellulose preparations, determined by the reversible methylene blue method; the  $\text{HSO}_3$  could not be determined by this method. C.

**Cellulose: Structure.** F. T. Peirce. *Nature*, 1944, 153, 586-587. The crystalline structure of cellulose suggested by Meyer and Misch and a molecular structure based on the view of Cox and co-workers that the five carbon atoms of the pyranose ring are nearly co-planar are critically discussed. A form is suggested in which the pyranose rings are turned from the plane of similarly orientated



chains towards the plane containing chains of alternating sense. Molecular structures assigned to native and regenerated cellulose are shown. C.

**Nitrocellulose and Vinylite Resin: Mechanism of Solution.** A. K. Doolittle. *Ind. Eng. Chem.*, 1944, **36**, 239-244. The action of solvents on macromolecular substances is studied, and threshold concentration and viscosity data are given for nitrocellulose in various solvent-diluent mixtures and for Vinylite resin in mixtures of nitroparaffins with *n*-butanol or *n*-heptane. It is suggested that two principal equilibria are simultaneously operative in the solution of resinous substances—solvation-desolvation and aggregation-disaggregation. The rate of desolvation is substantially fixed at constant temperature, but the rate of solvation is a function principally of solvent concentration. The threshold concentration required to initiate the solution process diminishes to a constant minimum value in ascending a homologous series of solvents. This minimum value, called "class threshold concentration," is independent of the diluent and therefore serves as an absolute comparison of different classes of solvents for a given resinous substance. The aggregation-disaggregation equilibrium of the solute macromolecules depends on the solvation-desolvation equilibrium, since disaggregation results when the "active centres" are solvated. In fluid solutions the extent of aggregation of the solute macromolecules increases linearly with decrease in solvent concentration, but as the solvent concentration approaches the threshold value, desolvation permits aggregation at multiple points of contact. The result is either gelation or precipitation. In film formation, the high viscosity, resulting from aggregation by means of gradual two- and three-dimensional growth as the resin desolvates during evaporation of the solvent, obstructs the tendency of the macromolecules to unite with one another at the maximum number of points of contact. A rather extended structure results. Plasticization prevents complete desolvation of the resin, and therefore diminishes the opportunity for the macromolecules to unite with one another at multiple points of contact. In this manner a less rigid structure is produced. C.

**Starch Conversion Products: Refractive Index.** J. E. Cleland, J. W. Evans, E. E. Fauser and W. R. Fetzer. *Ind. Eng. Chem., Anal. Edn.*, 1944, **16**, 161-165. A procedure for the determination of the refractive index of starch conversion products is described and results are presented for corn syrups and corn sugar syrups made by the simple hydrolysis of starch by acid. The refractive index of these products decreases with increasing dextrose equivalent. The effect of ash (sodium chloride) is to increase the refractive index. The decrease of refractive index with increasing dextrose equivalent is proportional to the increase in dextrose equivalent if the ash content of the products is also proportional to the dextrose equivalent. The temperature/refractive index relationship is linear within the range 18° to 45° C. when the concentration exceeds 14 per cent. of dry substance and within the limits of precision of a four-place instrument. Tables are presented covering the refractive index/dry substance relationship for commercial starch conversion products and refractive index/commercial Baumé for typical commercial products of different dextrose equivalents. C.

**Dipyrromethene and Triphenylmethane Dyes: Structure.** K. J. Brunings and A. H. Corwin. *J. Amer. Chem. Soc.*, 1944, **66**, 337-342. A consideration of various derivatives leads to the following conclusions: (1) The structure of the dipyrromethenes is profoundly influenced by the substituents on the pyrrole rings; (2) the position of the substituents is critical; (3) substitution of carboxy groups increases stability of the colourless covalent form of the methene, but alkyl substitution favours the ionic salt structure; (4) alkyl substitution on the pyrrole nitrogens results in steric interference causing a decrease in the stability of the ionic coplanar form and is, therefore, opposite to the effect predicted on the basis of the electrical effect of alkyl groups. The preparation of several new dipyrromethene carbinols, and of two colourless dipyrromethyl bromides which are analogous in structure and behaviour to triphenylmethyl bromide, is reported. It is shown that steric interference of hydrogens or substituents ortho to the bridge carbon atom exerts a strong influence on the structure of both the triphenyl and dipyrromethane dyes. The present observations on the dipyrromethenes and previously established data on the triphenylmethane series are correlated on the basis of a common electronic interpretation.



Certain differences in behaviour are explained by a comparison of the structural geometry of the two dye systems. C.

**High Polymers: Chain Configuration; Statistical Theory.** P. J. Flory and J. Rehner, Jr. *Ann. N.Y. Acad. Sci.*, 1943, **44**, 419-429 (through *Chem. Abstr.*, 1944, **38**, 1162<sup>9</sup>). The theory is examined in the light of more recent knowledge about the potential hindering rotation about single C—C bonds. It is shown that the form of the distribution function of possible distances between chain ends is not changed by the introduction of this potential. The average distance, however, is increased. Various methods for calculating elastic moduli of flexible networks are discussed. The authors' treatment leads to a stress-strain curve identical with the one derived by Wall. Swelling phenomena in such networks are considered on the basis of the authors' theory. C.

**Lyophil Protein Evaporation Apparatus.** D. H. Campbell and D. Pressman. *Science*, 1944, **99**, 285-286. A simplified lyophil apparatus which has proved satisfactory for small-scale laboratory work is described and shown in diagrams. Solutions to be dried are placed in pear-shaped flasks which are placed in a dry ice freezing mixture until the contents are frozen solid. The flasks are then connected to a condenser which is cooled with a freezing mixture of dry ice and ethyl cellosolve, and the assembly is evacuated. The temperature inside the flasks depends upon the rate of evaporation, and under the described conditions is well below freezing until all the water has been removed. The rate of evaporation may be increased by blowing a current of air over the flasks or immersing them in cold water. Materials being dried from very dilute solutions have a tendency to be carried out of the flask with the current of water vapour; this may be prevented without causing any appreciable decrease in evaporation by placing a gauze screen over the opening of the flask. A curve is given showing the amount of water remaining as a function of time for 150 g. of distilled water distributed equally among three flasks. Complete dryness was achieved in about 5 hours. Water is evaporated from protein solutions at a comparable rate, depending to some extent on the hygroscopic nature of the material. C.

**Wheat Flour Proteins: Sulphydryl Group Content.** H. S. Myers and E. B. Working. *Cereal Chemistry*, 1944, **21**, 32-37. Nitroprusside and ferricyanide tests for sulphydryl groups were made on the various fractions of wheat flour before and after denaturation. No indications were obtained of the presence of either reactive or unreactive sulphydryl groups in the gluten proteins. There appeared to be no free sulphydryl groups in the soluble protein fraction of flour. Definite indications were, however, obtained of the presence of unreactive sulphydryl groups which were liberated on denaturation of these soluble proteins. The presence of sulphydryl groups in the lipid fraction was confirmed. C.

**Adsorbed Phases: Condensation and Supersaturation.** H. M. Cassel. *J. Amer. Phys.*, 1944, **12**, 115-116. It is pointed out that in the derivation of Langmuir's adsorption isotherm the interaction of neighbouring adatoms has been neglected. Consequently, the equation of state of the monolayer corresponds to that of a compressed gas above its critical point. The treatment of multilayers in the adsorption of vapours is considered, and it is shown that an expression for the film pressure derived from the Emmett-Brunauer-Teller adsorption isotherm leads to the conclusion that the surface tension of the finally built-up, presumably liquid film would be negative. This result is attributed to the disregard of lateral cohesion in the design of the film model. In considering the mutual attraction of adatoms, cluster formation and phase transitions can be anticipated. Accordingly, the adsorption isotherm of a vapour must show a discontinuity, of course also in the case of perfect wettability. Then, depending on the free energy of nucleus condensation, metastable mono- or multilayers should be observed. It is very likely that the hysteresis in capillary condensation represents a supersaturation phenomenon of this kind. C.

**Adsorption Isotherms: Derivation.** W. D. Harkins and G. Jura. *J. Chem. Phys.*, 1944, **12**, 112-113. It is pointed out that the treatment of the adsorption of vapours on the surfaces of solids should not be considered as independent of, but as only a part of a general treatment of, the behaviour of insoluble and adsorbed films on the surfaces of liquids and of solids of all types. Since the

fundamental property of a surface, which determines the adsorption of a vapour or the spreading of an insoluble film, is the free energy of the surface itself, this quantity should be the fundamental basis of the treatment of this subject. Equations which give the pressure-area relations of insoluble oil films on water should apply also to adsorbed films on solids or on liquids. From these considerations a new basis has been adopted for the determination of equations for adsorption isotherms. This consists of considering as impractical attempts to develop a general equation for an entire adsorption isotherm, and in the determination of a single equation for each of the known phases which exist in oil films on water. A later step is to apply these equations to the pressure-area relations exhibited by isotherms for films on solids. In some cases one equation fits two different phases, but with very different values of the constants. It is found that the equations for insoluble films on water fit equally well for adsorbed films on solids. When the equation for a condensed film on water is applied to films on solids it is often found that the plot obtained exhibits two straight lines such as to indicate the existence in the film on the solid of two condensed phases with a second-order transition, and thus an absence of a latent heat, between them. The transition between the intermediate and the condensed film may be considered as of the third order. Examples of this are found in films of propyl alcohol on barium sulphate or anatase, and of nitrogen on certain catalysts used in the petroleum industry, or on certain charcoals. The only previously recognised phase on solids is the gaseous film. C.

**Cellulosic Films: Shrinkage on Precipitation.** F. H. Müller. *Kolloid Z.*, 1943, 103, 144-145 (through *Chem. Abstr.*, 1944, 38, 1161<sup>1</sup>). The author describes shrinkage and other allied phenomena observed when films of polystyrene, polyisobutylene and cellulose derivatives are cast from solutions of these materials on to glass or water. C.

**Films on Solids: Expanded and Intermediate Phases.** G. Jura and W. D. Harkins. *J. Chem. Phys.*, 1944, 12, 114. From a study of adsorbed films of butane on porous solids (catalysts) at 0° C. it is shown that the equations developed for insoluble monolayers on water in the liquid expanded and intermediate phases are valid for certain films adsorbed on the surfaces of non-porous and porous solids. From this evidence the conclusion is reached that these two non-condensed phases exist in films on the surfaces of solids as well as on liquids. C.

**Liquid Expanded and Intermediate<sup>ac</sup> Monolayers on Water: Pressure-Area Relations.** G. Jura and W. D. Harkins. *J. Chem. Phys.*, 1944, 12, 113-114. Equations for the pressure-area relations of liquid expanded and intermediate films of insoluble materials on aqueous sub-phases are obtained by integration of the equations for compressibility. The equations obtained represent experimental data adequately. Curves are given showing the application of the equations to the liquid expanded and intermediate films of pentadecylic acid at 27.5° C. on water. C.

**Paraffin Chain Salt Solutions: Surface Activity; Effect of Electrolytes.** R. G. Aickin and R. C. Palmer. *Trans. Faraday Soc.*, 1944, 40, 116-120. The addition of electrolytes to solutions of paraffin chain salts increases the surface activity of these solutions, and the effect is due almost entirely to the ions of opposite sign to the surface active species. A theory is developed which takes into account the charge and size of the ions and explains the difference in the effect of various added ions of the same valency on the surface activity of paraffin chain salts. C.

**Elastic Structures: Solution of Stress Problems; Lattice Analogy.** D. McHenry. *J. Instn. Civ. Engrs.*, 1943, 21, 59-82 (through *Sci. Abstr.*, 1944, 47 A, 32). The author describes a computation method for the numerical solution of almost any type of two-dimensional stress problem involving elastic materials. The method is one of successive approximation. It is derived in two ways, one employing Taylor's theorem, and the other by the lattice analogy in which each small element of the section is replaced by a braced square frame composed of six elastic members which have certain defined properties. The solution of the lattice is exemplified by the case of a plate stressed

by forces acting in its plane; determination of the stresses follows. Hints are given on the successful application of the method. C.

**High Polymers: Elasticity and Flow.** R. Simha. *Ann. N.Y. Acad. Sci.*, 1943, 44, 297-312 (through *Sci. Abstr.*, 1944, 47 A, 39). This paper deals with rate phenomena in amorphous materials in general, and particularly in amorphous high polymers, when one of the variables, shearing stress, volume, pressure or temperature, changes rapidly. The molecular mechanisms, responsible for the large elastic deformations in rubber-like materials are briefly examined. The case of elastic deformation in high polymers is explored. With certain simplifications, a statistical treatment will afford numerical results for the equilibrium value of the high elastic component of deformation. Rubber-like elasticity accompanies the existence of relatively free rotation within a chain as determined by the interactions along the main chain skeleton and by the nature and size of the side groups. Distinctions between rubber-like materials (polyisoprene, neoprene, and polyisobutylene) are examined. C.

**Plastic Materials: Shear Strength.** R. T. Schwartz and E. Dugger, Jr. *Modern Plastics*, 1944, 21, No. 7, 117-121, 164-166. A report is given of determinations of the shear strength at room temperature of various thermoplastic and thermosetting plastic materials. Two standard procedures were used, consisting of testing in double shear (1) rectangular specimens from sheets of  $\frac{1}{16}$ ,  $\frac{1}{8}$  and  $\frac{1}{4}$ -inch thickness, employing a Johnson-type shear jig with compressive loading, and (2) cylindrical specimens from sheets of  $\frac{1}{8}$ -in. or greater thickness, using a 3-plate-type shear jig with tensile loading. The results are tabulated and discussed. The average ultimate shear strength of the thermosetting plastic materials ranged from 4,400 lb. per sq. inch for transparent, unfilled allyl-derivative plastic material to about 12,000 to 18,000 lb. per sq. in. for the various laminated phenolic paper- and fabric-base plastic materials. The shear strength of the thermoplastic materials ranged from 200 lb. per sq. in. for a cellulose acetate material to 10,000 lb. per sq. in. for polyvinyl chloride-acetate. Shear values of the thermosetting plastics obtained on sheets of different thicknesses in the Johnson jig were comparable and were in turn comparable with the values obtained on the 3-plate jig. With the Johnson jig, higher shear values were obtained with a decrease in thickness of the thermoplastic materials. The higher shear values are considered nearer the actual shear strength. The values obtained on material  $\frac{1}{8}$ -in. thick were comparable with those obtained with the 3-plate jig. On fracturing, most of the filled materials showed relatively smooth separation planes whereas most of the unfilled materials showed jagged irregular surfaces. Shear strength was higher edge-wise than flat-wise for a phenolic laminate prepared with high-strength paper base, though no significant difference was observed for a phenolic-resin-impregnated laminated compressed maple. Shear strength parallel to the laminations was much lower than for other directions for laminated materials. There was no specific correlation between shear strength and compressive or tensile strength. C.

**High-molecular Substances: Vibratory Grinding.** E. Steurer. *Chem. Tech.*, 1943, 16, 1-3 (through *Chem. Abstr.*, 1944, 38, 1152<sup>4</sup>). The principal mechanical and chemical effects, the relation between the energy developed in the mill and the molecular energy of the substance, the energy balance, and the atomic energy and compression strain are discussed. Electron and Röntgen photographs are given in the original paper. C.

**Pigments: Mounting for Electron Microscopy.** M. L. Fuller, D. G. Brubaker and R. W. Berger. *J. Appl. Physics*, 1944, 15, 201. The following method for the preparation of pigment mounts has been found successful with a wide variety of zinc oxide pigments, leaded zinc oxide, titanium dioxide, zinc sulphide and lithopone. Approximately 0.01 g. of the pigment is milled on a glass plate with a glass muller using 3 drops of a 1 per cent. solution of poppy-seed oil in amyl acetate. The mulling is continued until the paste is nearly dry. To the paste are added 3 drops of a 2 per cent. solution of nitrocellulose in amyl acetate. This is milled until the solvent has evaporated. About 8 drops of a 2 per cent. solution of nitrocellulose in isopropyl acetate are added and milled for a few seconds (long enough to put the pigment in suspension), and 1 drop of this is allowed to spread on the surface of a saturated solution of salt. A portion of the resulting thin film is removed on a glass slide, refloated on

water to wash away the salt, and then attached to the standard 200-mesh screen disk. The individual steps are briefly discussed and the advantages of this method are pointed out. C.

**Shewhart Quality Control Chart: Application.** W. E. Deming. *Mechanical Engineering*, 1944, 66, 173-177. The effects of the use of the statistical method in quality control are outlined and the underlying principles are explained. The two kinds of mistakes occasionally made in quality-control programmes are: (1) Looking for an assignable cause of variation or increasing the amount of inspection, when the variations in quality are only random. (2) Failing to look for an assignable cause of variation or failing to increase the amount of inspection, when an assignable cause actually does exist. The Shewhart control chart has been designed to answer the question, when to look for an assignable cause, by striking an economic balance between these two kinds of mistakes. The use of this control chart is explained. It is pointed out that the statistical work can only be effective if it is accompanied by good engineering control of the process, training of the personnel, frequent review of sampling and test procedures with careful checks on actual performance, and frequent calibration of instruments and gauges. C.

**Halogens: Action on Wool. I. Factors Influencing the Amount of Halogen Adsorbed from Solutions in Carbon Tetrachloride.** C. S. Whewell and A. Selim. *J. Soc. Chem. Ind.*, 1944, 63, 121-123. The amount of chlorine adsorbed by wool from solutions of the gas in carbon tetrachloride depends on the duration of treatment, concentration, bulk ratio, temperature, regain, type of wool and any chemical treatment to which it may have been subjected. Deaminating reagents caused a much greater decrease in the adsorption than those which attack the disulphide links. Human hair adsorbed less chlorine than wool; differences between root and tip wools were small; differences between untreated and sodium sulphide-treated wools were insignificant; hydrogen peroxide-treated wool adsorbed less chlorine than untreated wool. W.

**Cystine: Rate of Liberation from Proteins by Acid Hydrolysis.** W. C. Hess and M. X. Sullivan. *Archives of Biochem.*, 1943, 3, 53-60. Six proteins (wool, finger nail clippings, lactalbumin, gliadin, edestin and  $\alpha$ -globulin of the lima bean) were hydrolysed by hydrochloric acid, hydrochloric acid-formic acid and hydriodic acid containing 1 per cent. hypophosphorous acid, for periods from 15 min. to 24 hr., and the cystine liberated estimated by the Sullivan and Okuda methods. The maximum values by all 3 hydrolysis procedures for each protein were practically identical. There are indications that the sulphur of wool is tied in more than one form; this possibility will be investigated. Hydrolysis with 5 and 10 per cent. hydrochloric acid indicates that the liberation of cystine from wool is a second order reaction. W.

## 10—ECONOMICS

**Wool and Synthetic Fibres.** P. Larose. *Wool Rec.*, 1944, 65, 547. Many arguments in favour of wool show a misunderstanding of its desirable characteristics, especially of its resiliency, and advertising will be ineffective unless it is based on a proper programme of research. W.

**Wool and Synthetic Fibres.** (1) H. Schofield. (2) J. Bolland. *Wool Rec.*, 1944, 65, 587. Reference is made to Larose's statements (see preceding *Abs.*), (1) It is extremely unlikely that for purposes of warmth wool will be replaced by any synthetic production. (2) Judging from "over-the-counter" sales, and from an example of research into new methods of improving the handle and durability of wool fabrics, the wool trade cannot be accused of complacency in the face of competition from synthetic fibres. W.

**British Patent System.** Chartered Institute of Patent Agents. *Engineering*, 1944, 157, 356. It is pointed out that the patent system is based on the recognition of a temporary proprietary right in the technical creations of the individual mind. Criticisms of the system and suggested modifications are discussed. Provisions against abuses are shown to be adequate and cases of alleged abuse rare. The addition of a provision designed to ensure that monopoly rights held in Great Britain shall not be a hindrance to the full creation and satisfaction of the demand for a patented article in export markets is recommended.

The proposal for the universal adoption of some general system of issuing licences under all patents as a right open to all persons interested in the manufacture of the patented invention ("licences of right") is subjected to a critical study and the conclusion is reached that such a system of compulsory licensing is inadvisable on the ground that it would retard the progress of invention for the following main reasons: (1) enterprise in developing and exploiting inventions would suffer on account of uncertainty and insecurity; (2) research by individual firms would be restricted; and (3) the practice of secret working of inventions would develop wherever possible, thus removing the incentive to scientific progress which is derived from publicity and wide circulation of information. It is suggested, however, that the principle of "licences of right" should operate to a full or partial extent in relation to patentable inventions resulting from State-financed research. It is also suggested that, in regard to the patenting of inventions resulting from State-financed or State-aided research, it is in the national interest to consider whether there should be established under the general supervision of the State, a body which might procure patents in other countries for the protection, to the national benefit, of important inventions. C.

**Textile Wholesale Prices, April, 1944.** *Bd. Trade J.*, 1944, 150, 177. The wholesale price index numbers for April are Cotton 150·1, Wool 183·8, Other textiles 134·1 (1930=100). C.

**Cotton: World Supply and Consumption.** *Rayon Organon*, 1943, 14, 163-165. Tables are given showing the world supply and consumption of American and all cotton in the period 1920-1943. The American production in 1943 is estimated at 11,450,000 bales, making with the carry-over a total domestic supply of 22,019,000 bales of American cotton, 9 per cent. lower than the peak of 24,374,000 bales in 1939 and 5 per cent. lower than the 1942 supply of 23,138,000 bales. The mill consumption of native cotton in the United States for the 1942 season was estimated at 10,930,000 bales or slightly lower than the peak year 1941, but 62 per cent. higher than the pre-war season 1938-39. The carry-over of all cotton on August 1st, 1943, amounted to 10,657,000 bales, and that in other countries to 13,257,000 bales. For the season ending July 31, 1943, the world production of all cotton was estimated at 26,483,000 bales, making a total supply for that season of 49,003,000 bales. During the period, United States mill consumption aggregated 11,100,000 bales, whilst mill consumption in other countries declined to a figure of 13,750,000 bales, making a total world consumption of all cotton of 24,850,000 bales, or 3 per cent. lower than the previous season and 13 per cent. below the pre-war season of 1938-39. C.

**Hosiery: American Production in 1942.** *Rayon Organon*, 1943, 14, 61-66. A table is given showing productions in the United States of the various types of hosiery in 1942 and 1941. The 1942 total of all types amounted to 147,902,058 dozen pairs, compared with 149,968,435 in 1941. Production of women's full-fashioned hosiery declined from 41,818,722 dozen pairs in 1941 to 35,082,296 in 1942. In the first half of 1942, rayon hosiery accounted for 54·5 per cent. of the total women's full-fashioned output, whilst in the second half of the year the rayon share increased to 88·3 per cent. The 1942 output of all types of women's seamless hosiery was about 3 per cent. below that of 1941. Women's rayon seamless hosiery production in 1942 at 8,088,000 dozen pairs represented 60·6 per cent. of the total production. Higher production levels in 1942 were achieved in men's half hose and slacks, socks, cotton and woollen bundle goods and anklets. Production declines occurred in athletic socks, ribbed goods and children's and infants' wear. Details are given of the Office of Price Administration price ceiling order on women's full-fashioned and seamless rayon hosiery and the War Production Board hosiery conservation order. C.

**Industrial Products: Distribution.** F. B. Turck and W. E. Hill. *Mechanical Engineering*, 1944, 66, 183-191. Twelve scientific distribution principles, namely, customer development, corporate accounts, stabilizing, demand for capital goods, marketing budgets, distribution planning, pricing policy, distribution administration, diversification, product development, market development, sales organisation and foreign distribution, are discussed and illustrated by the actual experience of leading industrial companies. C.

**Lancashire Cotton Industry: Structure.** Cotton Board. *Textile Manufacturer*, 1944, 70, 147, 157. The average spinning mill in Lancashire has about 85,000 mule-equivalent spindles, compared with 35,000 in Germany, 20,000 in Italy, 70,000 in the northern United States and 30,000 in the southern States, and 40,000 in Japan. More than 85 per cent. of British spindles are in mills with more than 60,000 spindles each, and 10 firms alone control 40 per cent. of the spindles. In weaving, however, the ten large firms control only 10 per cent. of the looms. In the finishing section the ten large "converters" had in 1939-40 an annual turnover of 25 to 80 million yards and controlled one-fifth of the export trade. The unique feature of the British industry is the relatively small extent of "vertical" organization. Combined spinning and weaving concerns control only 18 per cent. of the spindles and looms in Lancashire as against 40 per cent. in Germany. Further, the ten large converters responsible for 15 per cent. of their trade control only 5 per cent. of the looms. In the United States, combined spinning and weaving firms control 80 per cent. of the spindles, nearly all the looms, and half of the finishing trade. C.

**Lancashire Weaving Industry: Reconstruction.** F. W. Lowcock. *Textile Manufacturer*, 1944, 70, 144-145. Suggestions are made for the improvement of the cotton and rayon weaving industry, by attention to loom design and conditions of employment, and by financial aid for plant renewal and export of cloth. A Reconstruction Committee to control the industry is advocated. C.

**Silk: Dwindling Application.** A. D. Kelly. *Rayon Textile Monthly*, 1944, 25, 73-75. In 1920 raw silk sold in the United States for more than \$18 per lb. and georgette throwing was done at \$5 per lb. In the 1930's raw silk fell to \$1 per lb. In the peak year (1929) the weaving trade consumed about 32,000 bales per month and the fully-fashioned hosiery trade about 19,000 bales, or about 37 per cent. of the total. In 1941, the hosiery trade consumed about 18,000 bales out of a total of 23,000 bales per month. It is considered that real silk will not recover from the introduction of nylon for hosiery. Other replacements of silk include rayon in hosiery, ribbons, neckties and velvets, nylon for parachutes, and chemically treated cotton or spun rayon for artillery powder bags. C.

**Rayon: World Production.** *Rayon Organon*, 1943, 14, 169-171. World rayon production increased from 2,227,500,000 lb. in 1939 to 3,472,900,000 lb. in 1942, a gain of 56 per cent. The two countries contributing most to this increase were Germany with a gain of 480,000,000 lb. and the United States with an increase of 252,700,000 lb. Of the 1942 world total production, 1,447,200,000 lb. was filament yarn (an increase of 26 per cent. on 1941) and 2,025,700,000 lb. was staple fibre (87 per cent. increase). Production of both filament yarn and staple fibre in Great Britain showed a decline. For filament rayon yarn manufacture countries ranked for both 1939 and 1942 as follows: United States, Japan, Germany, Italy and Great Britain, but the ranking for staple fibre production was Germany, Japan, Italy, Great Britain and the United States for 1939, and Germany, Japan, Italy, United States, France and Great Britain for 1942. When arranged according to total rayon production for 1942, Germany leads with 1,100,000,000 lb. (32 per cent. of the total), Japan follows with 700,000,000 lb. (20 per cent.) and the United States with 632,600,000 lb. (18 per cent.). C.

**Textile Fibres: Consumption in United States, 1942.** *Rayon Organon*, 1943, 14, 30-32. Tables and charts are given showing the consumption of cotton, wool, rayon and silk in the United States in the years 1920-1942. The consumption of raw cotton in 1942 reached a new record of 5,616,600,000 lb., an increase of 8 per cent. above the previous record of 5,208,500,000 lb. in 1941. Scoured wool consumption in 1942 at about 610,000,000 lb. was 7 per cent. below the record level of 652,200,000 lb. used in 1941. Rayon consumption (continuous filament plus staple fibre) in 1942 at 620,600,000 lb. passed the record 591,700,000 lb. of the previous year by 5 per cent. and was more than double the figure for 1937. C.

**Textile Fibres: Production and Applications.** Cotton Textile Institute, U.S.A. *Rayon Textile Monthly*, 1944, 25, 13-14, 67-68, 119-120, 172-174. A report is given of a conference on the respective fields of application of the various fibres (the "battle of the fibres"). (1) S. B. Hunt discusses statistics

of production and consumption. The amounts consumed in the United States were, in millions of lb.:—

	1920	%	1930	%	1940	%	1943	%
Cotton (raw) ...	2,828	(88·9)	2,610	(85·0)	3,962	(81·0)	5,455	(80·8)
Rayon (all types)	9	(0·3)	119	(3·9)	482	(9·9)	643	(9·5)
Wool (scoured) .	314	(9·9)	263	(8·6)	411	(8·4)	652	(9·7)
Silk (raw) ...	29	(0·9)	76	(2·5)	36	(0·7)	—	—

The average price of cotton was 34 cents per lb. in 1920, 6 cents in 1932, and is now 21 cents. Wool was 166 cents per lb. in 1920, 66 cents in 1932, and is now 115 cents. Viscose rayon (150 den.) was 600 cents per lb. in 1920, 49 cents in 1938, and is now 55 cents; viscose staple is 24 cents per lb. (2) H. de W. Smith discusses war-time developments of rayon, e.g. for parachutes. (3) F. J. Groten, and (4) A. Hafner refer to Velon cordage and its low inflammability. (5) O. B. Bromley and (6) G. Fuller describe the present position of Aralac (casein) fibre. (7) J. S. Irvine and (8) E. S. Twining describe the properties of spun glass fibre. C.

**Wages: Cost of Living Sliding Scales.** *Planning*, 1944, No. 220, 3-17. The adoption of cost of living sliding scales since about 1916, the method of computing the cost of living index, and various criticisms of the index are discussed. Details are given of the way in which the scales have worked in building and civil engineering, in railway, iron and steel, coal and cotton industries, and in the Civil Service. It is pointed out that during periods of sharply rising prices the pegging of wages to prices will inevitably accelerate the course of the inflation. The workers on sliding scales will then do well, but at the expense of all whose incomes are not adjusted automatically. In the period of falling prices, on the other hand, pegging of wages to prices will mean that deflation is accelerated, as every fall in prices, due to inadequacy in demand, will proportionally reduce wages and consequently demand itself. If wage policy were sufficiently well coordinated between workers and employers and between different industries, it could be arranged that wages should not fall as much as prices during the downswing, and that in return they should not be pushed up so much as would otherwise be the case when prices were once more rising. Such a policy has actually been put into practice in Sweden. From the workers' point of view it would be wrong to peg wages to the cost of living and thus stabilise real wages, if the productivity of the workers was increasing and prices were falling, for this would mean that their share in the product of their labour would be declining. But the use of sliding scales does not preclude the workers from claiming wage increases outside of the scale. If post-war employment policy succeeds in producing a steadily rising national income it is expected that workers in most industries will prefer to rely on their bargaining power rather than on automatic scales. The value of sliding scales varies with the industry. Cost of living calculations will remain of the greatest importance, whether or not an automatic sliding scale is used, as they affect almost all wage negotiations, and all kinds of subsistence allowances, social security payments and minimum wages can most logically be related to a cost of living index. There is an urgent need for an accurate cost of living index, or a number of indices. C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**British Industry: Dependence on Foreign Research.** G. M. Garro-Jones. *Engineer*, 1944, 177, 356. A warning is issued against buying from other countries, under monopolistic conditions, the results of their research activities. This dependence on foreign research was manifest in a number of industries, such as engineering and shoe manufacture, before the war, when certain trades hired at great cost machinery from foreign countries or leased the rights for that plant machinery which they were not allowed in any way to alter. That system made costs rigid and stultified further research. It has been estimated that over half (by value) of the machine tools operating in Birmingham to-day are of American origin. Others of British make are to some extent, no doubt, the subject of patent rights. These imported machine tools have been indispensable to the expansion of war output but their possession is not an unmixed



blessing. The usual life of such tools in a British factory is probably 20 years, whereas in American factories they would be scrapped and superseded by improved plant after about three years. It is suggested that each industry not yet participating in a research association should form a small committee to consider its scientific and technical needs and then discuss the circumstances with the Department of Scientific and Industrial Research. C.

**Scientific Research: Organisation in Great Britain.** (1) *Nature*, 1944, 153, 539. (2) *Parliamentary Debates (Hansard)*, Vol. 399, No. 62, 19/4/1944, column 216-311. A report is given of a recent debate in the House of Commons. The debate revealed a growing recognition of the importance of improving the remuneration, status and conditions of service of the research worker. Tributes were paid to the achievements of research workers in Great Britain and the importance of quality in the research worker was emphasized. It was agreed that fundamental research, on which progress ultimately depends, must be the task of the universities and that there must be much greater expenditure both on fundamental research and on teaching at the universities. It was recommended that industrial research should be directed to the industrial processes which exist in Great Britain, to the discovery of new industries, and especially to the utilization of raw materials which exist at home and in the Colonial Empire. The expansion of research in such fields as animal diseases and nutrition, food and nutrition, soil fertility, and biology, including fisheries, was repeatedly urged. It was suggested that the machinery for giving grants to the universities should be brought more directly under the Office of the Lord President of the Council, who already has the Department of Scientific and Industrial Research under his wing. Other suggestions were that an advisory council for the universities should be formed for the interchange of experience and the prevention of overlapping, that fundamental research should be organized by some sort of parliament of science, and that the Scientific Advisory Committee should be asked to prepare a plan for the development and carrying on of scientific research for a 10-year period. The need for more workers with scientific training in industry, a rapid development of scientific and technical education, closer contact between those engaged in scientific research and those concerned with its practical application, and the discovery of further means of assisting the development and the practical evolution of new industrial ideas was pointed out. Reference was made to the Mellon Institute and its system of industrial fellowships. It was stated that the Government recognizes the need for the establishment of some fund to meet the cost of developing new inventions and of providing facilities for testing new ideas for industry. The best way to meet this need and to fit it in with the work of the research associations is now under examination but Government support for research must be backed by a readiness to use the results of that research and the main responsibility for applied research must continue to fall on industry itself. C.

**Juvenile Textile Workers: Recruitment.** A. Draper. *Silk and Rayon*, 1944, 18, 425-426. A report of a lecture to secondary school pupils on the prospects for employment and training in the textile industries as engineers, executives and supervisors, and testing laboratory workers. C.

**American Textile Research Institute: Establishment of Headquarters at Princeton, N.J.** *Textile Research*, 1944, 14, 66. The Textile Research Institute Inc., has decided to establish headquarters for the prosecution of research and for the training of personnel on the graduate level at Princeton, N.J. The President of Princeton University has declared that the University would afford the opportunity for members of the staff to enrol in graduate courses and proceed to advanced degrees. The programme of study and the research work would be arranged to the mutual satisfaction of the Graduate School and the Textile Research Institute. C.

**Scientific and Industrial Research: Organization for India.** Sir S. S. Bhatnagar. *Indian Textile J.*, 1944, 54, 201-202. A report of an address outlining a scheme for the organization of scientific and industrial research in India. C.



# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### 1—FIBRES AND THEIR PRODUCTION

#### (C)—VEGETABLE

**Cotton: Production in Northern Nigeria.** Sir Geoffrey Evans. *Textile Weekly*, 1944, 33, 906. Impressions gathered on a visit to Nigeria in February and March, 1944, are briefly reported. The village people were bringing in the final pickings from the tops of the cotton plants. The cotton was of excellent grade but weak, and the suggestion is made that a late harmattan (intensely dry north wind) had led to premature desiccation of the plants and bolls and thus to immature fibre. The crop is expected to reach 50-60 thousand bales, but not more than 10,000 will be available for export. The Hausa people make and favour coarse, rather thick hard-wearing cloth. C.

**Sperguson (Tetrachloro-*p*-benzoquinone) Cottonseed Disinfectant: Toxicity.** T. H. McGavack, L. J. Boyd, R. Terranova and D. Lehr. *J. Ind. Hyg. & Toxicol.*, 1943, 25, 98-111 (through *Bull. Hygiene*, 1944, 19, 284). Sperguson, which is used for the treatment of cotton seed, comprises 99 per cent. of tetrachloro-*p*-benzoquinone and 1 per cent. of Na<sub>2</sub>H phosphate. An intensive study has been carried out with 385 rats, and skin tests have been performed on rabbits. When a sufficient dose was given Sperguson caused loss of weight and strength, hæmoconcentration, preagonal azotæmia, leucopenia with a relative polymorphonucleocytosis, and an inconstant, late increase in the coagulability of the blood. "Carbol urine" was present when these drug effects were elicited. The drug is, however, only slightly toxic to healthy animals; it may comprise 0.5 per cent. of the diet for prolonged periods without effect. Animals in poor health may become more easily affected. Even so, there seems to be little danger of intoxication to either man or animal from this seed protectant. If all the agent were retained during handling and during its preparation for consumption by animals, concentrations would not rise above 0.2 per cent. Such a dose was found to be below the threshold of toxicity. C.

#### (D)—ARTIFICIAL

**Cellulose: Consumption by American Rayon Industry.** *Rayon Organon*, 1944, 15, 51 and 53. A table is given showing annual consumptions of wood and linters pulps, and the approximate number of bales of raw cotton linters necessary to yield the linters pulps, in the period 1930-1943. Total pulp consumption during 1943 amounted to 336,500 short tons, 84 per cent. of this being wood pulp and 16 per cent. linters pulp. C.

**Man-made Fibres: Developments.** (1) and (3) C. S. Jones. (2) H. J. Stern. (1) *India-Rubber J.*, 1944, 106, 281-285, 309-312. (2) *Ibid.*, p. 313. (3) *Ibid.*, p. 341. (1) A concise review is given of modern developments in (a) casein fibre (Aralac), (b) "Bubblfil" substitute for kapok, (c) spun glass, (d) spun rock wool, (e) nylon, (f) Velon, (g) aluminium foil coated yarn ("Reymet" foil and "Reyspun" yarns), (h) soybean fibre, (i) "Plexon" plastic-coated yarns, and (j) nettle fibre. (2) It is claimed that "Bulaira" of the French viscose manufacturers (1938-39) anticipated du Pont's "Bubblfil." (3) A reply to (2). C.

**Paper Pulp: Reactivity during Xanthation.** G. Jayme and Kuo-fu Chen. *Zellwolle, Kunstseide, Seide*, 1943, 48, 47-63 (through *Chem. Zentr.*, 1943, i, 2744 and *Chem. Abstr.*, 1944, 38, 1637<sup>4</sup>). Previous studies by various workers are reviewed. Methods for the determination of the reactivity during xanthation at accurately defined conditions and precipitation of insoluble residues are discussed. For a number of pulps residues of 8.1 per cent. (sulphites of low strength) to 43 per cent. (sulphites of high strength) were found. The reactivity

could not be expressed by a single analytical value, but can be expressed by the formula  $R_1 = [\alpha\text{-cellulose content (white content)}^2] / [\text{xanthate viscosity} \times 10,000]$ . The reactivity of these pulps is closely related to the nature of the primary lamella as it is influenced by the hydrolytic or oxidative decomposition of the lamellae. The reaction inertia of the stronger sulphate products is related to the hydrolysis of the primary wall. Good filtering property is governed not only by the  $R_1$  value, but also by the amount of ash, resin, etc. The influence of the various treatments during viscose-manufacture and of the acid and alkali cellulose after-treatment are discussed. The reactive rayon fabrics must have low strength values in all cases. C.

**Xanthated Soda-pulp Fibres: Swelling and Solution.** W. Schramek and H. Schwarz. *Leipzig. Monats. Textil-Ind.*, 1941, 56, 11-16 (through *Chem. Zentr.*, 1941, ii, 133 and *Chem. Abstr.*, 1944, 38, 1637'). For the solution of xanthated soda pulp fibres the outer layer surrounding the fibre must be dissolved first and then various stages of decomposition take place with simultaneous extensive swelling. The process of solution and the appearance of the fibre undergoing this process are described in detail. C.

**Cellulose Pulps: Sources and Preparation.** W. Schieber. *Jentgen's Kunstseide u. Zellwolle*, 1941, 23, 228-234 (through *Chem. Zentr.*, 1941, ii, 2159-2160 and *Chem. Abstr.*, 1944, 38, 1876'). Possible raw materials for the German pulp and rayon industries apart from forest trees, are straw, potato tops, flax and hemp chaff, broom, nettle, sunflower, cornstalks and Italian reed (*Arundo donax*). Details are given of the structure, available quantities and cellulose contents of these plants and of the composition of the pulp obtained by the different methods. Sulphate pulp may show 90 per cent.  $\alpha$ -cellulose and still contain 25-30 per cent. pentosan. A method is described for the pulping of pine, beech, potato tops, etc., by a modified sulphate process in which an acidic pre-hydrolysis renders the hemi-celluloses soluble in alkali. The solution from the acid hydrolysis contains about 20 per cent. of the wood in the form of fermentable sugar. The harmful effluents from the sulphite process may be improved by diffusion washing and rational evaporation. C.

**Casein Fibres: Production.** P. Eckert and E. Swatck. *Kleipzig's Textil-Z.*, 1941, 44, 983-986 (through *Chem. Zentr.*, 1941, ii, 2894 and *Chem. Abstr.*, 1944, 38, 1883'). The precipitation of casein from skim milk by acid is improved by higher temperatures of precipitation or of after-warming. At 20° the casein precipitates only poorly and the whey nearly always remains turbid; however, during after-warming there takes place a gradual balling and flocculation of casein particles. At higher precipitation temperatures the separation takes place immediately in large flakes. Temperatures above 72° lead to a simultaneous precipitation of the albumin (whey protein). If an insufficient amount of acid is used for the precipitation and if the pH value of the whey after the precipitation is about 4.5-5.0, then the casein precipitates in large flakes; however, if the amount of acid is increased the casein precipitates in small flakes. The most favourable acid concentration is that corresponding to the isoelectric point. The viscosities of alkaline casein solutions of the same composition depend on the pH value and the precipitation temperature. The lower the pH value the more slowly the viscosity of the solution increases. At the same pH value but different precipitation temperatures the higher precipitation temperature causes a quicker increase of viscosity. The method of adding the acid has no influence on the viscosity. The properties of alkaline casein solutions whose casein was precipitated at a higher pH value can be influenced by supplementary acid precipitation. An increase of the ripening temperature causes a rapid increase of the viscosity. C.

**Protein Fibres: Production.** H. P. Lundgren and R. A. O'Connell. *Ind. Eng. Chem.*, 1944, 36, 370-374. Investigations of the viscosity and electrophoretic behaviour of solutions of mixtures of native and denatured egg albumin and feather keratin with sodium alkyl benzenesulphonate are discussed and evidence is given of an unfolding of the native egg albumin structure and of the formation of protein-detergent complexes. When precipitated by salts the protein-detergent complexes are either flocculent or slimy, depending on the ratio of protein to detergent. Dispersions of egg albumin and chicken-feather keratin with alkyl benzenesulphonate form ductile precipitates when the ratio

lies between 40-60 and 60-40 protein-detergent. Viscous solutions of mixtures having these proportions and compositions above 17 per cent. of total solids can be extruded through a spinneret into a bath of salt solution to give fibres that can be stretched and reeled. When allowed to dry the fibres are weak and attempts to produce orientation by drawing in the presence of steam have been unsuccessful. After removal of the detergent, e.g. with aqueous acetone, it is possible to draw the fibres over 300 per cent. in live steam. After proper annealing at lower temperatures, such fibres exhibit positive birefringence and a high degree of molecular orientation as determined by X-ray diffraction. The stretching is accompanied by an increase in tensile strength and in water resistance, and a decrease in the range of elastic deformation. Fibres have been prepared from chicken-feather keratin and egg albumin with tensile strengths of over 70,000 lb. per sq. in., which compare favourably with those of natural fibres. The fibres with a high degree of molecular orientation show moisture retention comparable to that of wool. C.

#### PATENTS

**Polyamide Filaments: Treatment to Improve Impact Strength and Thermo-extensibility.** E. I. Du Pont de Nemours & Co. B.P.561,344 of 12/10/1942: 16/5/1944 (Conv. 13/10/1941). Synthetic linear polyamide filaments of improved impact strength and thermo-extensibility are obtained by treating orientated filaments of synthetic linear polyamides in a solution of a phenol in a solvent that is a non-solvent for the filaments, for a time and at a temperature and concentration insufficient to dissolve the filaments, removing the phenol by means of a solvent that does not dissolve the filaments, and finally drying, the various treatments being carried out while the filaments are under tension. The concentration of the phenol solution and the time of soaking are so regulated that the filament (water saturated) absorbs at least 4 per cent. of its weight of the solution, but does not absorb enough to become sticky or to dissolve. Filaments processed in this manner, especially those ranging from 30 to 70 mils in diameter, are useful as strings for tennis and similar rackets. Large filaments can also be used as tyre cords. C.

**Rayon Spinning Bucket Cover.** American Viscose Corporation. B.P.561,687 of 5/2/1943: 31/5/1944 (Conv. 20/3/1942). A spinning bucket cover has a number of radially slidable cover-locking members arranged to be thrown centrifugally into engagement with a spinning bucket on rotation therewith, the members having bucket-engaging portions at their outer ends and upwardly and inwardly sloped portions arranged at their inner ends and adapted to be embraced and to be moved inwardly by a common encircling device whereby release of the cover-locking means from the bucket is effected. The cover may be provided with upstanding means affording manual gripping thereof, and with manual releasing means. A removable cake-supporting member and a device insertable into the bucket through the cover for gripping the cake-supporting member and releasing the cover-locking means may be provided. C.

**Polyamide Compositions: Production.** E. I. Du Pont de Nemours & Co. B.P.561,701/2 of 7/8/1942: 1/6/1944 (Conv. 10/9/1941). (1) A composition suitable for use in the manufacture of filaments, films, sheets, coatings and the like comprises a synthetic linear polyamide plasticized with a mixture consisting of a phenol and a neutral, completely esterified ester of a carboxylic acid in which at least one of the alcohol residues is the residue of an aliphatic carboalkoxy alcohol wherein the organic radical connecting the alcoholic hydroxyl and the carboalkoxyl group contains not more than six carbon atoms. The phenol may be an alkyl ester of a fatty acid containing a hydroxyphenyl nucleus attached to the acid residue. (2) A composition suitable for use in the manufacture of filaments, films, sheets, coatings and the like comprises a synthetic linear polyamide plasticized with a mixture consisting of a solvent plasticizer and a neutral completely esterified ester of a carboxylic acid in which at least one of the alcohol residues is the residue of an aliphatic carboalkoxy alcohol wherein the organic radical connecting the alcoholic hydroxyl and the carboalkoxyl group contains not more than six carbon atoms. The solvent plasticizer may be a sulphonamide. The resulting plasticized polyamide compositions and articles made from them are very pliable and do not become tacky at moderately elevated temperatures. C.

**Monofilaments: Production.** American Viscose Corporation. B.P.561,772 of 15/10/1942:5/6/1944 (Conv. 18/11/1941). A method of forming a unitary filament comprises the steps of fusing a bundle of thermoplastic filaments, e.g. a vinyl resin, subjecting the filamentary material to a superficial swelling treatment, drying, and polishing with pumice or other abrasive powder wetted with olive oil or other lubricant. Preferably, the filamentary bundle is treated with a solvent or swelling agent, and after evaporation of the agent is subjected to the process described in B.P.560,535, or any other suitable procedure for converting it into a monofilament, which is then polished. The monofils may be used in the production of hosiery, knitted or woven fabrics, e.g. nets, violin strings, strings for tennis rackets, bristles, artificial horsehair, etc. C.

**Viscose Spinneret Alloy.** Baker & Co. Inc. (Newark, N.J.). U.S.P.2,334,890. An alloy for a viscose spinneret consists of Pt 90-95 per cent., Rh 3-7.5 per cent. and Ru 2-5 per cent. C.

**Molten Glass Spinning Apparatus.** Owens-Corning Fiberglas Corporation. U.S.P.2,335,135. The bottom of the receptacle that holds the supply of molten glass is furnished with a number of rows of nipples through which the glass descends in a number of fine streams. C.

**Casein Fibres: Treatment.** Karl Börner (Germany; vested in the U.S. Alien Property Custodian). U.S.P.2,335,576. Fibres spun from casein and hardened by formaldehyde are floated in a bath containing not more than 0.1 per cent. of ammonia. C.

**Viscose-Sulphonamide Stretch-spun Rayon: Production.** E. I. Du Pont de Nemours & Co. U.S.P.2,335,592. A stretch-spun filament of "improved loop tenacity" is obtained from a mixture of viscose and a sulphonamide of more than 10 C atoms, at least four of which are in a straight chain, the N atom not bearing a substituent. C.

**Water-repellent Rayon Filaments: Spinning.** E. I. Du Pont de Nemours & Co. U.S.P.2,335,980. Water-repellent filaments and films are obtained by extruding into a regenerating bath an aqueous solution of cellulose in a quaternary ammonium compound,  $Z \cdot CH_2 \cdot N(t) \cdot Hal.$ , and then heating the product to split of the volatile tertiary amine represented by  $N(t)$ ; Z is an aliphatic radical of at least 10 C atoms attached to the  $CH_2$  group through a trivalent N atom. C.

**Rayon Yarn Shrinkage Controlling and Winding Device.** Industrial Rayon Corporation. U.S.P.2,336,019. In a method for controlling the shrinkage of rayon, the thread is given a temporary undulating form, advanced in this form in helical turns along the periphery of a thread-advancing thread-storing device, and then treated with a shrinking medium to eliminate the undulations. C.

**Depilating Hides.** G. Berg (to J. Hüchel's Söhne). D.R.P. 731,682 of 14/1/1943 (through *Chem. Abs.*, 1944, 38, 657). An apparatus for the mechanical depilation of hides is described; it produces an un haired hide and hair suitable for the hat industry. W.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Cotton Mill: Modernization.** J. Buckley. *Textile Manufacturer*, 1944, 70, 207-209, 253-255. An illustrated account is given of the machinery and lay-out that might be adopted to modernize a 64,440 mule spindle mill producing about 40,000 lb. of (average) 36s double-roving yarn in 48 hours. The plan is based on the "combined operations" of single-process lapping, lap drawing, and high-draft ring spinning. C.

### (B)—SPINNING AND DOUBLING

**Vibrationless Speed Frame Drive.** Messrs. Tweedales and Smalley Ltd. *Textile Weekly*, 1944, 33, 870-875. An illustrated account is given of a new model speed frame in which previous noisy gearing, especially that from the differential pulley to the bobbin shafts, is replaced by helical-cut gears and chain drives. The drafting is by a 4-line roller system. C.

## (C)—SUBSEQUENT PROCESSES

**Nylon Yarn: Twist Setting.** *Textile Manufacturer*, 1944, 70, 217-218. The writer discusses the problem of setting the twist in a rayon yarn without at the same time setting the yarn as a whole in its wound form, e.g. loops. A test for "twist liveliness" (snarling tendency) is described and also a creasing angle test for the extent of yarn setting. Patented processes for twist setting are reviewed. [See E. I. Du Pont de Nemours Co., B.P.519,038 and 553,303 (*Summary*, 1940, p. 207 and 1943, p. 370); Imperial Chemical Industries Ltd., B.P.559,369 C.

## PATENTS

**Spindle Driving Apparatus.** F. Heald and Tweedales & Smalley (1920) Ltd. B.P.561,352 of 14/11/1942:16/5/1944. In a positive drive for spindles of spinning and twisting machines of the kind in which each spindle is driven by a pair of spiral or bevel gears, one gear of each pair is rotatable on the bolster of the spindle and drives the latter and the other is mounted on a driving shaft section, a number of which are detachably coupled together to constitute a main driving shaft, one section being provided for each spindle. The drive is transmitted to each spindle from that spiral gear which is rotatable on the spindle bolster through the intervention of a clutch which may be on the shaft section or on the spindle unit. The drive is transmitted to the bobbin platform in such a manner that the spindle retains its flexibility for carrying varying unbalanced loads, the bobbins being driven from the platform by pins or other driving members. Each spindle driving unit is provided with a control member for putting the clutch out of operation and subsequently applying a brake for bringing the spindle to rest, movement of the control member in the opposite direction releasing the brake before engaging or allowing the engagement of the clutch to start the spindle. A portion of each spindle bolster, together with the spiral gears and other attendant parts, is enclosed in a gear case which forms an oil well in which one of the gears is partly submerged. The spindle itself can be lifted out of its bearing without disturbing the gear case. The oil for lubricating the spindle and the oil for the gears are entirely separated. The gear case, spindle, gears and shaft section constitute one self-contained unit which can be bolted on to the spindle rail of the machine, each spindle and driving unit being independent of its neighbour. C.

**Portable Spindle Brake.** Celanese Corporation of America. U.S.P.2,334,748. A portable brake for a spindle assembly that has an oil well in its swing stem comprises a handle, a lever arm extending at an angle from the handle and ending in a brake shoe, and a pin at the junction of the handle and lever arm for insertion in the oil well. C.

**Glass Fibre Bat.** Owens-Corning Fiberglas Corporation. U.S.P.2,335,102. A light-weight, strong, resilient bat of glass fibre is obtained by simultaneously depositing from a gaseous atmosphere glass fibre and an aqueous emulsion containing petroleum and a water-soluble, thermo-setting aldehyde condensation product, drying off the water so that the oil and resin separate on the surface of the fibre, fluffing up the fibre into a loose mat, and applying heat to set the resin and stiffen the mat. C.

**Ring Twisting Frame Traveller.** Victor Ring Traveler Co. U.S.P.2,335,121. The claim is for a traveller that rides vertically on a twister ring with its main plane radial to the direction of travel. The head portion has a rounded inner bearing surface and the foot portion is flattened where it engages the ring. C.

**Ring Traveller.** Herr Manufacturing Co., Inc. U.S.P.2,335,566. The claim is for a traveller that is much wider than thick and has rounded edges so that it provides a smooth, full-sweep, thread-engaging surface, and offers a minimum wind resistance. C.

## 3—CONVERSION OF YARNS INTO FABRICS

## (C)—WEAVING

**Weaving Efficiency: Loom Stoppages.** "Portex." *Wool Rec.*, 1944, 65, 799, 801. In weaving fancy woollens and worsteds on the standard dobby loom, shuttle-changing is the chief source of stoppages. Its relation to the count of yarn, size of weft pirn, and sett and width of cloth is discussed. W.

## PATENTS

**Winding Machine Stopping Mechanism.** Universal Winding Co. B.P. 561,219 of 8/10/1942:10/5/1944 (Conv. 28/11/1941). A yarn winding machine having stopping mechanism is provided with a device for arresting the operation when the package reaches a predetermined size, comprising a member actuated continuously by the drive of the machine and constituted by a going member that is movable bodily by and with the growth of the package. This arrangement ensures that undue pressure on the package is obviated when the stopping mechanism is brought into operation. C.

**Loom Cloth Roller Grip.** J. A. Sutcliffe. B.P. 561,247 of 6/11/1942:11/5/1944. The cloth on the cloth roller is gripped against the sand roller by a flexible connection that is anchored at one end and passed under the cloth roller up and over the sand roller down to and under a rail or other convenient fitting, up and over the cloth roller and down to an anchorage, the amount of grip between the cloth roller and the sand roller being regulated to any particular requirement by a screw connection or other tension producing device interposed in the flexible connection. A spring or springs may also be provided in the flexible connection for taking up any variation in tension therein. C.

**Patterned Fabrics: Knitting.** R. Kretser (Bayside, Long Island, U.S.A.). B.P. 561,339 of 7/9/1942:16/5/1944. A method of knitting a multi-yarn fabric comprises the steps of knitting each one of a number of yarns, each yarn being fed exclusively to one of the needles of a multi-feed knitting machine in selected intermittent courses to form an intermittent series of individual stitches wale-wise of the fabric, from each of the yarns, knitting a number of other yarns to form a series of course-wise stitches, floating these yarns across the wrap stitches and floating the wrap stitch yarns across the course-wise stitches in the courses where the wrap stitches are not formed. Yarns of different colour and type may be used. Patterns similar to those produced on a loom are produced by this method. Details are given of a suitable circular knitting machine for carrying out this method of knitting. C.

**Knitted Glove.** C. F. Schuessler (Chicago). B.P. 561,449 of 2/2/1943:19/5/1944 (Conv. 17/1/1942). A knitted glove has its front side provided with an area of close stitches and the portion of its back aligned with the area of close stitches formed of relatively loose stitches. The finger and thumb portions are provided on their front sides with areas of close stitches and their backs are formed of relatively loose stitches. The finger and thumb portions have at least one row of relatively loose stitches encircling their bases whereby they are joined to the body of the glove. If desired tight stitches may be provided on the inner face of the glove body and the bottom portion of the glove. The tightly knitted areas resist wear and the loose stitches on the back provide for freedom of movement and flexibility. The glove tends to form a curve which fits the normal curvature of the hand. C.

**Loom Shuttle Guard.** F. Stuttard and J. O. Whittaker. B.P. 561,751 of 27/11/1942:2/6/1944. A loom shuttle guard comprises front and rear rods spaced at any required distance apart and interconnected. The rear rod is pivoted and slidable in two end brackets fixed to the sley cap, each bracket being formed with a ledge on which a cranked portion of the front rod normally rests, a block adjustably mounted on the rear rod being formed with surfaces adapted to interlock with corresponding surfaces on an intermediate bracket and retain the guard in its operative position on the ledges. The guard is capable of being moved in an endwise direction in the brackets against the action of a spring for the purpose of effecting the disengagement of the interlocking surfaces and when this disengagement has been effected the guard can be turned in an upward direction until it rests against the front of the sley cap in which position it is out of the way of the weaver. When the loom is set in motion the momentum of the sley automatically causes the guard to fall down to its operative position. C.

**Pile Fabrics: Production.** A. E. O'Dell (Collins & Aikman Corporation, U.S.A.). B.P. 561,769 of 8/8/1942:5/6/1944. A method of face to face weaving of **W** pile fabrics includes the steps of interconnecting the grounds with pile-forming yarn, temporarily forming a number of sequential loops, free

from interlacing with the grounds, in the interconnecting pile warp yarn and supporting such loops at their bights by supported elements lying in different planes which are spaced from one another in a direction normal to the grounds, any one such element having loops on only one side of it, releasing the support of the bights, spreading the grounds, and cutting the interconnecting pile-forming yarn to separate the fabrics. The method may include the additional step of forming a pile loop secured at both ends in a single ground. The two pile fabrics are woven simultaneously on a loom equipped with stationary warp-wise gauges having free ends. C.

**Cellulose Ester Insect Screen.** C. Dreyfus. U.S.P.2,334,754. The claim is for an open-mesh fabric with yarns made by twisting and adhesively setting strips of cellulose ester foil. C.

**Circular Loom Weft Feeler Motion.** B. F. Goodrich Co. U.S.P.2,335,111. The claim is for a weft feeler arm which is pivoted to the shuttle of a circular loom and actuates a circuit breaker to stop the loom when the weft on the bobbin reaches a pre-determined condition. C.

**Weft Tensioning Device.** Draper Corporation. U.S.P.2,335,142. Normally stationary means are mounted on the breast beam of the loom for independently gripping the weft and cooperate with means carried by the sley to take up slack in the weft as the sley beats forward. C.

**Self-threading Shuttle.** Draper Corporation. U.S.P.2,335,534. The claim is for means to prevent the weft from rising up out of the side delivery eye in the shuttle. It employs a bundle of resilient fibres so arranged that they can bend to admit the weft, but prevent it from rising up. C.

**Shuttle Weft Tension Equalizing Device.** Draper Corporation. U.S.P.2,335,483, 2,335,563. The threading block of a shuttle for an automatic weft-replenishing loom contains friction means for engaging the weft, which cooperate with independent means actuated by the weft to vary the friction in inverse relation to the tension in the weft. C.

**Self-threading Shuttle.** Draper Corporation. U.S.P.2,335,564. A thread guiding device, controlled by resilient means, is pivoted in the passage leading from the threading block so that it can guide the weft into position and hold it against displacement by looping. C.

**Tubular Fabric Loom.** National Rubber Machinery Co. U.S.P.2,335,654. A horizontal circular loom for weaving tubular fabric on inflexible mandrels has change-speed gearing connections between (a) the drive for the revolving shuttle and shed-forming mechanism and (b) the mandrel-conveyor so that the speed of the conveyor is variable with respect to the speed of the loom proper. C.

**Creel-to-Beam Tape Frame.** S. P. Ouzts (Hodges, S.C.). U.S.P.2,335,880. The claim is for a tape frame on which yarn is fed directly to the sow-box from a creel *via* a walk-way. C.

**Elastic Filament Winding Apparatus.** Filatex Corporation. U.S.P.2,335,965. In a machine for winding elastic filaments under tension, means are provided for increasing the rate of rotation of the supply package, and the greater rate of operation of the winding-on means, in proportion to the increase in diameter of the wound package. C.

**Yarn Winding Machine.** Celanese Corporation of America. U.S.P.2,335,975. The claim is for means to cause the traverse frame assembly that carries the reciprocating yarn guide to recede steadily at a controlled rate from the axis of the yarn package as the package builds up. C.

**Knitting Machine Stop Mechanism.** Michael Wachsman. U.S.P.2,335,979. A thread-supporting arm is connected to a lever pivoted inside a box and an operating arm in the box, on the same lever pivot, is kept in sliding engagement with a spring that trips the lever on failure of the thread. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (G)—BLEACHING

**Persulphates: Use in Bleaching and Desizing.** J. Rièrè. *Teintex*, 1941, 6, 130-133 (through *Chem. Zentr.*, 1941, ii, 1345 and *Chem. Abstr.*, 1944, 38, 1885<sup>6</sup>). The author discusses the production and properties of persulphates.



They are mostly stable in solution at 35°, but at 80° a brisk evolution of oxygen occurs. Metals have a strong catalytic action on this reaction. Since acid salts and free sulphuric acid are formed in the decomposition of the persulphates, care must be taken to provide for the neutralisation of these acids if the fabric is not to be converted into weaker hydrocelluloses. In the work reported persulphates were used for the desizing of cotton fabrics. For continuous operation the bath contained 2 g. of potassium persulphate, 15 c.c. of caustic soda of 40° Bé., 1 g. of fatty alcohol sulphonate and 2 g. of soap per l. The bath temperature was 80–90°. Hydrogen or sodium peroxide can be added to the bath to improve the bleaching action. The process can also be combined with kier boiling if 1 kg. of K persulphate is added to 1500 l. of the caustic soda at 50–60° and the liquor is then slowly heated to 100°. The active oxygen in the persulphate can be determined by splitting off of nitrogen from hydrazine according to the method of Pannain, by the use of oxalic acid and silver peroxide according to Kempf or by the methyl alcohol method of Marie and Kunel. C.

#### (H)—MERCERISING

**Cotton-Rayon Cloths: Mercerising and Bleaching.** P. Colomb. *Teintex*, 1941, 6, 163–167 (through *Chem. Zentr.*, 1941, ii, 2158 and *Chem. Abstr.*, 1944, 38, 1646<sup>6</sup>). General information is given concerning the history and varieties of artificial fibres. Staple fibres of the viscose and cellulose acetate type are discussed. Mixed weaves of cotton and viscose rayon are mercerised with a mixture of caustic soda and caustic potash or with addition of sodium chloride. In this process the gloss is reduced, but the dyeing qualities are increased. Cuprammonium staple fibre is mercerised at 15–20° with caustic soda (7–5° Bé.) and a wetting agent. Mercerising of cloths containing 35, 55 and 75 per cent. artificial fibres mixed with cotton is discussed. The material is desized with Rapidase or Diastafor, scoured with soda or sodium phosphate and bleached in sodium hypochlorite or with hydrogen peroxide in water glass. C.

**Cotton-Wool Mixture Fabrics: Mercerisation.** J. Besançon. *Teintex*, 1941, 6, 102–104; *Monit. Maille*, 1941, 51, 33–35 (through *Chem. Zentr.*, 1941, ii, 1571 and *Chem. Abstr.*, 1944, 38, 1885<sup>4</sup>). Data are given on the effect of alkali on wool, the dyeing of semi-wool fabrics with sulphur dyes, the mercerisation of cotton fabrics containing wool and subsequent dyeing with aniline black, and the mercerisation of cotton fabrics with wool in the selvages. Caustic soda liquor of 28° Bé. does not cause any appreciable damage to wool; the damage is caused only on washing when the alkali is diluted to 19° Bé. Under 19° Bé., no damage takes place. The impregnation of fabrics with formaldehyde protects the wool very well; however, it is more economical to pass through the dangerous alkali region by rapid washing with cold water. During the acidification it is advantageous to leave in the rinsing bath the sodium sulphate that is formed by the reaction between sulphuric acid and caustic soda, as it has a protective action on the fibre. The acid must be washed out carefully from the wool because of its effect on the dye. Wool that has not been completely deacidified absorbs aniline black. Alkali-damaged wool absorbs direct dyes at a lower temperature than does wool that has been treated in the ordinary way. The alkali acts chemically on the sulphur group of wool. C.

#### (I)—DYEING

**Dye Solution Concentration Recording Device.** T. B. Davenport. *J. Sci. Instruments*, 1944, 21, 84–86. By means of a photo-electric device for measuring the light absorption of a dye solution which is being circulated through a mass of textile material, the variation in concentration of dye with time can be derived and the progress of the dyeing operation followed in detail. Light from a 12V, 36W spot-light bulb is modulated by a rotating sector disk and focused by a lens on the flattened portion of a cross-tube connecting towards their upper extremities the two limbs of a U-tube containing the temperature controlled coloured solution which circulates rapidly through the system under the action of a rotating stirrer. The textile material is contained in a 3 in. length of glass tubing fitted at the lower end with a perforated porcelain disk allowing free circulation of the dye solution, the whole fitting snugly in one limb of the U-tube. The light is partially absorbed by the coloured solution circulating through the cross-tube and is then passed through a suitable colour



filter and focused on the cathode of a vacuum photo-cell by a second lens. The photo-cell is placed in the anode circuit of a pentode valve so connected that the voltage developed between anode and cathode shall be a logarithmic function of the photo-current. This voltage is applied to the input of a three-stage resistance capacity coupled amplifier, the output of which is rectified by a double-diode, and measured on a galvanometer of low sensitivity inserted in the cathode lead. The relation between solution concentration and galvanometer reading is linear. The construction and operation of the apparatus are described in detail, and diagrams and some typical results are given. C.

**Rayon Staple Fibre: Fast Dyeing.** F. G. Krüger. *Deut. Textilwirt.*, 1941, 8, No. 11, 31-33 (through *Chem. Zentr.*, 1941, ii, 1449-1450 and *Chem. Abstr.*, 1944, 38, 1643<sup>9</sup>). Rayon staple fibres are classified as (1) those that can be dyed with weakly acid or nearly neutral acid dyes (casein fibres, animalized staple fibre, Pe-Ce, nylon, etc.), (2) those that can be dyed with all dyes applicable to vegetable fibres (viscose, cuprammonium rayon, etc.), and (3) those that need special dyes, e.g. acetate rayon. Directions are given for dyeing with indanthrene and sulphur dyes. Special equipment needed for fast dyeing of loose staple fibre is described. C.

**Viscose Yarn Cakes: Dyeing.** C. M. Whittaker. *J. Soc. Dyers & Col.*, 1944, 60, 109-114. The advantages of dyeing viscose yarn in cake form are pointed out and a cake dyeing machine is described. Various precautions necessary in the dyeing process are outlined. Details are given of procedures for the application of direct, vat and azoic dyes, and difficulties experienced in attempts to use sulphur dyes and to apply vat dyes by the pigment padding process are briefly discussed. C.

**Dyed Cotton Fabrics: Deterioration by Light.** Sulphur Dyed Textile Materials: Accelerated Ageing Test. See Section 5C.

**Artificial Leather Base Fabrics: Dyeing and Dressing.** P. Hardy. *Teintex*, 1941, 6, 96-99 (through *Chem. Zentr.*, 1941, ii, 1329-1330 and *Chem. Abstr.*, 1944, 38, 1882<sup>8</sup>). Cotton and rayon are used for base fabrics for artificial leather. Formulae are given for dyeing with aniline black, sulphur black and logwood. Formulae are also given for mottled colours. Dressing of cotton fabrics with size, or better, with emulsified vinyl resins such as Emulsion 5000 (Soc. Rhone-Poulenc) is described. Rayon fabrics are desized with sodium phosphate and a fatty alcohol sulphonate and then dyed with direct dyes. Dressing can then be done with Emulsion 5000 or with a polyacrylic acid resin, as e.g. Plextol D (Röhm and Haas). Coating is carried out in an apparatus in which the fabric passes between rollers through a trough and is freed from excess impregnating material by means of a scraper. C.

**Chrome Green: Inflammability.** H. Berger. *Arbeitsschutz*, 1941, 141-144 (through *Chem. Zentr.*, 1941, ii, 2475 and *Chem. Abstr.*, 1944, 38, 1882<sup>6</sup>). Dry mixtures of Chrome Green should not be prepared in heavy edge mills. It is advisable to add 2 per cent. liquid petrolatum to the mixture. Finished mixtures of Chrome Green should be removed immediately from the proximity of pulverizing machines; they should be kept in fireproof containers. Dampness and impurities of vegetable oils should be avoided. Berlin blue is indicated to be the dangerous component of Chrome Green. C.

**Colour Lakes: Formation on Fuller's Earth.** H. Goldhahn. *Angew. Chem.*, 1941, 54, 377 (through *Chem. Zentr.*, 1941, ii, 2871 and *Chem. Abstr.*, 1944, 38, 1882<sup>9</sup>). Adsorption colours of different hydroxyazobenzene dyes on Tonsil (clay), floridin and aluminium hydroxide are discussed. The hydroxybenzenes corresponding to the dyes frequently give, on adsorption on fuller's earths from non-aqueous solution, characteristic colours which often correspond to the colours produced by the dyes. It is questionable whether colour lakes occur on the adsorption of hydroxybenzenes. C.

**Substantive Azo Dyes: Production.** C. F. H. Allen and F. P. Pingert. *J. Org. Chem.*, 1944, 9, 50-54 (through *Chem. Abstr.*, 1944, 38, 1882<sup>2</sup>). A discussion of the basic structure of substantive dyes and the term "substantivity," leads to the conclusion that a crossed-conjugated system of multiple linkages and particle size are two factors which contribute to substantivity. Multiple conjugation is a special case of certain resonating systems and it is not unlikely

that the electronic resonance formed causes the easily reversible agglomeration of the dye molecule to particles of roughly molecular dimension. The *o*-terphenyls can be considered as stilbenes in which a benzene ring takes the place of the ethylene group and 4:4'-diamino-*o*-terphenyl may give azo dyes which should be substantive for cotton. When this compound is tetrazotised and the tetrazo solution is added to an alkaline solution of a coupling component, monoazo dyes are easily formed. The coupling with two molecules of the naphthol is very slow unless the solution is strongly alkaline. Monoazo dyes formed with such coupling components as G-acid, J-acid, and urea do not colour cotton, but dye wool from an acid bath. A disazo dye is prepared by coupling tetrazotised 4:4'-diamino-*o*-terphenyl with 2 molecules of H-acid. When tetrazotised and coupled with H-acid in strongly alkaline solution, 4:4'-dinitro-*m*-terphenyl gives a dye which dyes cotton reddish blue at pH 7-8 in the presence of magnesium sulphate and shows greater substantivity than the isomeric terphenyl derivatives. 4':4''-Dinitro-*p*-terphenyl is slowly catalytically reduced at 110° and high pressure. Tetrazotised and coupled with H-acid, a violet dye is formed which dyes cotton directly in the presence of magnesium sulphate. C.

#### (K)—FINISHING

**Cellulose Ester Plasticizers: Solubility in Liquid Ammonia.** P. C. Scherer and E. O. Sternberg. *Rayon Textile Monthly*, 1944, 25, 143-145. Liquid ammonia was patented as a solvent for nitrocellulose and cellulose esters in 1921 (Nitrogen Corporation; B.P.182,488; U.S.P.1,544,809 and 1,544,812), but it was soon found that a plasticizer would have to be added in order to obtain flexible films from such solutions. The present authors have measured the solubility in liquid ammonia, at its boiling point, of a large number of plasticizers. The technique is described and the data are tabulated with a note where necessary to say whether or not the agent is stable in liquid ammonia. The triaryl phosphates are only slightly soluble, but the simple alkyl phthalates (C<sub>1</sub> to C<sub>6</sub>) are completely miscible with liquid ammonia. The solubility decreases rapidly with increase in the length of the alkyl chain. Diphenyl phthalate reacts vigorously. The glycol esters are freely soluble and stable in liquid ammonia but glycolate plasticizers react. Two agents of the sulphonamide type were found to be completely miscible and quite stable. C.

**Silk and Rayon Tricot Goods: Delustring.** J. Dutreillis. *Mon. Maille*, 1941, 51, No. 716, 35-36 (through *Chem. Zentr.*, 1941, ii, 1088 and *Chem. Abstr.*, 1944, 38, 1645<sup>3</sup>). In delustring with barium chloride and sodium sulphate solution it is best to centrifuge and not to rinse after the first bath. If barium hydroxide is used, a stable compound between the fibroin and barium hydroxide is formed; this is wash-proof and the goods can be rinsed to effect a more uniform delustring. A concentrated sodium sulphate solution must be used to convert the hydroxide completely into barium sulphate. It is better to delustre after dyeing than in the dye bath. Different delustring agents must be employed very finely divided; Gardinol is a suitable dispersing agent. Good adhesion of the delustring agent can be brought about with a penetrating agent or gelatinised starch followed by treatment with an oily softening agent. C.

**Sulphonated Peanut Oil: Preparation and Properties.** J. B. Gallent. *Amer. Dyes. Rept.*, 1944, 33, 148-149, 156. Uses of sulphonated oils are mentioned and the advantages and disadvantages of peanut oil as a raw material are pointed out. The properties of products obtained by sulphonating peanut oil with 98 per cent. sulphuric acid, fuming sulphuric acid, fuming sulphuric acid (40 per cent.) + sulphuric acid (60 per cent.), and chlorosulphonic acid, and by sulphonating a mixture of 75 per cent. peanut oil and 25 per cent. castor oil are described. A brief report is given of a test in which samples of cotton cloth were treated with a mixture of water 1,000 g., corn starch (40 fluidity) 60 g., oil (50 per cent. fatty matter) 50 g., kept in screw-cap jars for 7 days at 50° C., and then examined for odour and stain at the end of this period. Sulphonated peanut oils and a commercial product containing 70 per cent. peanut oil, 30 per cent. castor oil and 0.25 per cent. lecithin were used. The treated samples were free from odour and stain except samples containing oil prepared by sulphonating a year-old sample of peanut oil. These developed a slight odour, but a similar oil containing 0.25 per cent. lecithin gave satisfactory results. In

a mill test in which a peanut+castor oil product was used in a finishing mixture the cloth (blue denim) was processed and then stored for four weeks without the development of odours, and had a good handle, "slick" finish and bright colour. C.

**Cellulose Fibres: Hydrophobing.** H. J. Henk. *Kunstseide u. Zellwolle*, 1941, 23, 217-18 (through *Chem. Zentr.*, 1941, ii, 1572 and *Chem. Abstr.*, 1944, 38, 1883<sup>3</sup>). Free hydrophilic OH groups of cellulose, which cause the strong swelling of artificial fibres, can be rendered inactive by conversion to ethers or esters by means of a number of chemicals and the fibres can be crease-proofed by means of urea-formaldehyde products. These treatments are discussed in detail. C.

**Mechanical Finishes on Cotton and Rayon Fabrics: Increasing Permanence.** *Textile Mercury & Argus*, 1944, 110, 400 etc., 424 etc., 484 etc., 561 etc. A broad review of old and new methods. The influence of moisture content in Schreiner and lustre finishes is mentioned, and references are made to patented processes, in which synthetic resins, formaldehyde, organic quaternary ammonium compounds, and other special agents are used. C.

#### (L)—PROOFING

**Textile Materials: Water-, Fire- and Rot-proofing.** G. Stühmer. *Text. Ring*, 1943, 1, 22-24 (through *Chem. Zentr.*, 1943, ii, 1065 and *Chem. Abstr.*, 1944, 38, 1646<sup>6</sup>). Water-repelling, air-admitting impregnation is effected with aluminium acetate or formate (preferably aluminium triformate) and soap or paraffin emulsions. Textiles can be waterproofed with rubber, waxes, synthetic resins, etc. Synthetic single-bath impregnating agents are Ramasit, Imprägnol, Paralin and Anthydriol PL. Other waterproofing agents are Velan, Persistol, Netumid, Hydrophobol and Rotal. Suitable antiseptics are copper salts, formaldehyde, Preventol, Raschit and Amycol. Netumid protects against gnats, ammonium salts, phosphates, tungstates and stannates protect against fire, and Eulan protects against moths. C.

**Coated Fabrics: Water Vapour Permeability.** See Section 5C.

**Army Ducks: Finishing and Mildew Proofing.** E. C. Bertolet. *Amer. Dyes Rept.*, 1943, 32, 214-219, 226-227. Mineral dyeing and vat dyeing procedures and methods for the production of water repellent and mildew-resistant finishes on army ducks to comply with the U.S. Quartermaster Depot specifications are described. Mildewproofing compounds and methods of applying them are critically discussed, and the results of tests and of practical experience with copper, cadmium and silver compounds, phenyl mercury compounds, o-phenylphenol, and pentachlorophenol are reported. The mercurial antiseptics mentioned include phenylmercuric acetate and oleate, phenylmercuro-2:2':2''-nitritotriethanol lactate, and 9-phenylmercuro-10-acetoxy-12-octadecenoic acid. C.

**Vulcanised Rubber: Deterioration by Copper and Manganese Compounds.** E. C. B. Bott and L. D. Gill. *Trans. Inst. Rubber Ind.*, 1943, 19, 53-58. The authors report an investigation into the effects of Cu and Mn compounds on the tensile strength of vulcanised rubber sheet, these agents being introduced as stearates in a typical mixing. It is found that small amounts of Cu have about twice the effect of the same amounts of Mn. The deteriorations per day (at 82° C. in the Geer oven), D (per cent. loss of strength, dumb-bell specimens) follow a square-root law for Cu,  $D = 0.32\sqrt{[Cu]}$ , and a straight-line law for Mn,  $D = 0.013[Mn]$ , where [Cu] and [Mn] are concentrations in parts per million. The highest concentrations tried were 0.06 per cent. of Cu and 0.08 per cent. of Mn. Anti-oxidants in the mixing gave reasonably good protection against the effects. C.

**Mildew and Rot Resistant Fabrics: Testing.** See Section 5C.

#### PATENTS

**Synthetic Resins: Application to Fabrics.** United States Rubber Co. B.P. 561,152 of 22/10/1942:8/5/1944 (Conv. 24/1/1942). A fabric is immersed in an aqueous bath containing particles of synthetic resin which have been agglomerated from the dispersed state to the form of flocs which are macroscopic and readily separable from the aqueous medium on standing and which are capable of depositing on the fabric on contact therewith, and the fabric is

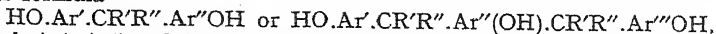
maintained associated with the bath until at least part of the flocculated particles of synthetic resin have been deposited on the fabric. The bath contains sufficient stabilizer to prevent the resin flocs from completely coagulating into a coherent lump, but insufficient stabilizer to prevent the flocs from depositing on the fabric. A preferred method of preparing the bath comprises treating a resin dispersion with a monovalent salt of a strong acid in the presence of both clay and a protein, such as gelatin, and also a stabilizer for the agglomerates. C.

**Cloth Tentering and Cropping Range.** G. K. Seddon and H. Blakeley. B.P. 561,164 of 23/12/1942:8/5/1944. A wet piece of cloth after being scoured is passed through a tentering machine for drying and attached to a wrapper which has been threaded through a cropping machine either at the front or at the back of the tentering machine, the tentering, drying and cropping then proceeding as one combined operation. Details are given of an arrangement in which the wet piece of cloth, after being scoured, is passed over rollers which occupy an elevated position, through a piece guider that guides and centres the cloth in its passage to another roller over which it passes down to and under a pair of spaced rollers or rods underneath a platform, up and on to the pins of the tentering and drying machine and through the latter, the end of the piece of cloth after being dried in the tentering machine being sewn to a wrapper that has been threaded through a cropping machine provided with one or two rotary cutters. C.

**Dihydroxy Azo Dyes: Production.** J. R. Geigy A.-G. (Basle). B.P.561,228 of 3/11/1942:10/5/1944 (Conv. 4/11/1941 and 25/7/1942). Monoazo dyes are produced by coupling diazotised 6-nitro-2-amino-4-alkylphenols, of which the alkyl group contains at least three C atoms, with azo components containing at least one water-solubilising group and which in *o*-position to the coupling point bear a hydroxyl group. The presence of the nitro group in 6-position in conjunction with an alkyl group with at least three carbon atoms in 4-position results in surprisingly good fastness to light and enhances the suitability of the dyes for the single-bath chroming process. C.

**Cellulose Acetate Materials: Dyeing.** British Celanese Ltd. B.P.561,249 of 7/11/1942:11/5/1944 (Conv. 15/11/1941). Acetone-soluble cellulose acetate textile materials are dyed by mechanically impregnating them with a solution of a dye in 20-50 per cent. acetone. By this method it is possible to effect very rapid incorporation of dye in the material and to ensure extremely good penetration even of heavy or closely woven fabrics. When dyeing fabrics it is usually of advantage to follow this operation by a topping operation in an aqueous dye bath free from acetone. In the dyeing of staple fibre products, e.g. carded or drawn slivers or combed tops, it is usually possible to dispense with the aqueous topping operation. The process described is particularly useful for dyeing acetone-soluble cellulose acetate materials with insoluble direct dyes. C.

**Azo Dyes: Production.** Calico Printers' Association Ltd., A. Burawoy, Margaret G. Barclay and G. H. Thomson. B.P.561,302 of 30/10/1942:15/5/1944. Water-insoluble mono- and poly-azo dyes are made by reacting one or two molecules of a diazonium salt of an aromatic amine or amino azo compound which does not carry any additional water-solubilising group such as  $-\text{OH}$ ,  $-\text{COOH}$ ,  $-\text{SO}_3\text{H}$ , with a coupling component of the phenolic type having the general formula



in which Ar', Ar'' and Ar''' are substituted benzene residues which do not carry any additional water-solubilising group, and one or more of which have at least one coupling position free, and R' and R'' are hydrogen or hydrocarbon residues. On textile materials yellow, orange and brown shades are produced which are characterised by very good fastness to light and washing, and very good dischargeability by formaldehyde sulphonylates. The shades may be modified and further improved in fastness to light by after-treatment with metallic salts such as Cu, Co and Ni salts. C.

**Laminated Plastic Sheets: Production.** Dux Chemical Solutions Co. Ltd., C. A. Redfarn and F. W. Elliston-Erwood. B.P.561,351 of 11/11/1942:16/5/1944. In a process for the manufacture of fibrous sheets, such as cloth and paper, impregnated with phenol-aldehyde resins for the production of

laminated materials, the impregnation is effected without the addition of organic solvents with the preliminary condensation product which, whether dissolved in or separated from water, is liquid when cold, and the impregnated material is dried by blowing hot air streams into it on both sides while it is travelling. C.

**Woven Glass Fabric: Roughening and Rubber Coating.** Rubbaglas Ltd. and G. W. Betteridge. B.P.561,356 of 20/11/1942:16/5/1944. Woven glass fabric is roughened by treatment with an etching solution, such as hydrofluoric acid, or by blasting with sand or other abrasive materials. A rubber mix may then be applied to the fabric and vulcanized. The coated product is suitable for use as an electrical insulating material, as damp-course, or for the production of waterproof clothing. C.

**Wind- and Water-proof Pile Fabrics: Production.** W. I. Taylor and J. F. Levers. B.P.561,376 of 10/11/1942:17/5/1944. A process for the production of wind- and water-proof effect fabrics comprises impregnating the backing of a pile fabric, of which the pile comprises flat filaments of a cellulose derivative, with a synthetic hydrophobe coating material, and subjecting the fabric before or after impregnation of the backing to the crinkling action of a boiling aqueous medium. The coating material may be an alkyd resin or a derivative of polyvinyl alcohol or of polyacrylic or polymethacrylic acid, a synthetic rubber-like material, or a cellulose derivative. Thermo-setting synthetic resins may be applied from solution or dispersion in an organic solvent while in a partially condensed condition, and the treated fabrics may be subjected to heat in order to convert the resins into the thermoset insoluble state. Plasticisers, pigments, etc., may be incorporated in the coating compositions. C.

**Saponified Cellulose Ester Yarns and Fabrics: Treatment to Increase Capacity for Shrinking.** British Celanese Ltd. and W. J. Simpson. B.P.561,402 of 13/11/1942:18/5/1944. The shrinkage on drying of textile materials consisting of regenerated cellulose yarns which have been obtained by stretching and saponifying yarns made of an organic ester of cellulose, is improved by impregnating the materials with a solution containing between 30 and 75 per cent. by weight of a mercerising and shrinking base, neutralising the base immediately after impregnation, and then washing the yarns free from acid. The treatment not only imparts to the yarns the requisite capacity for shrinkage on drying, but also improves their extensibility. Yarns may be treated in unassociated form or in the form of fabric. The mercerising agent is preferably caustic soda and the acid dilute hydrochloric or sulphuric acid. C.

**Chromable Monoazo Wool Dyes: Production.** W. F. Beech, M. Mendoza and Imperial Chemical Industries Ltd. B.P.561,516 of 18/9/1942:23/5/1944. Chromable monoazo wool dyes are manufactured by coupling diazotised *o*-amino-phenol or -naphthol monosulphonic acids, which may carry simple substituents such as halogen and nitro, with a 1-(phenoxyphenyl)-3-(methyl or phenyl)-5-pyrazolone wherein the phenyl groups may carry as substituents halogen, alkyl or alkoxy, but are otherwise unsubstituted. These dyes are eminently suitable for application by the meta-chrome process and yield strong dyeings, ranging in shade from orange-brown to bluish red, and of good fastness to washing, milling, potting and light. C.

**Monoazo Wool Dyes: Production.** Sandoz Ltd. (Freiburg, Switzerland). B.P.561,622 of 17/6/1942:26/5/1944 (Conv. 11/7/1941). Monoazo dyes are obtained by coupling diazotised aminobenzenesulphonamides, in which one H atom of the sulphonamide group is replaced by an acetyl group, with 1-aryl-5-pyrazolone-sulphonic acids. The products dye wool from acid baths in pure greenish-yellow shades of excellent fastness to light. C.

**Pigmented Emulsions: Preparation.** Interchemical Corporation (New York). B.P.561,641 of 26/5/1941:30/5/1944 (Conv. 3/8/1940). A three-phase, pigmented, stable emulsion, for textile fabric decoration, consists of an aqueous phase, a phase comprising a pigmented resin-organic solvent aggregate and a phase comprising an organic composition which is not fully miscible with the aggregate, an emulsifying agent being present in the emulsion. It is desirable that the aqueous phase should constitute at least 20 per cent. by weight of the emulsion and it is also preferred that the organic composition phase has

less than 10 per cent. of non-volatile components by weight. The resin employed is a synthetic resin of the kind convertible by heat to a form which is insoluble in washing and/or dry cleaning agents. The organic composition is preferably a thin lacquer of low solids content, which is capable of diluting the pigmented lacquer phase when added in small quantities, but causes the formation of a phase comprising pigmented resin-solvent aggregates in the low solid lacquer when added in larger quantities. The three-phase emulsions may be made by mixing a pigmented lacquer and an unpigmented lacquer and then emulsifying the same with water, or emulsifying either of the lacquers with water and then adding the other lacquer, or emulsifying each lacquer separately with water and then mixing the resulting emulsions. The use of such three-phase emulsions in printing makes possible much finer printing, permits the use of cheap pigments, and smaller quantities of pigments, and avoids the after-treatment necessary with conventional printing pastes. C.

**Pigments: Application in Dyeing.** Interchemical Corporation (New York). B.P.561,642 of 26/5/1941:30/5/1944 (Conv. 3/8/1940). A method of pigment dyeing a fabric while avoiding migration of colour on drying, comprises saturating the fabric with a pigmented water-in-lacquer emulsion containing at least about 20 per cent. by weight of an inner aqueous phase, and an outer continuous lacquer phase, and drying the fabric. The emulsion contains a synthetic resin which is convertible by heat to a form that is insoluble in washing and/or dry cleaning agents, such as a urea-formaldehyde resin. The fabric may be saturated with a three-phase emulsion the outer phase of which is a solution consisting essentially of volatile solvent having dissolved therein an agent capable of forming a water-in-lacquer emulsion, and the inner phases of which comprise an aqueous phase containing at least 20 per cent. of water based on the total weight of the emulsion, and a pigmented complex of solvent and heat-convertible synthetic resin, the total binder content of the emulsion being not above 2.5 per cent. C.

**Anthraquinone Dyes: Production.** E. I. Du Pont de Nemours & Co. and W. Dettwyler. B.P.561,754 of 27/11/1942:2/6/1944. Dyes of the dianthrimide carbazole type which carry on one of the anthraquinone molecules the benzothioxanthone nucleus and on the second anthraquinone molecule a benzoylamino group attached in an  $\alpha$ -position are prepared by condensing 5-amino-2:1(S)anthraquinone-thioxanthone with 1-chloroanthraquinones which carry in one of the positions 4, 5 and 8 a benzoylamino group, and ring closing the resulting anthrimide by treatment with aluminium chloride in nitrobenzene or in pyridine, and, preferably, further treating the product with an oxidising agent, e.g. sodium dichromate. The products are vat dyes which dye in orange to red shades from the usual alkaline hydrosulphite vat by either the warm or the cold dyeing method. The dyeings or prints have very good fastness to light, chlorine and washing. C.

**Mothproofing Wool, etc.: Use of Amino Acid Amide Derivatives.** H. Martin and W. Stambach (to J. R. Geigy A.-G.). U.S.P.2,325,331 of 27/7/1943 (through *Chem. Abs.*, 1944, 38, 496). 2 mol. dimethylamine or other primary, secondary or tertiary amine of the aliphatic, araliphatic, hydroaromatic or benzene series is treated in water with a compound of general formula (halogen-CH<sub>2</sub>-CO-NH)<sub>2</sub>X (X=an aromatic radical containing >1 benzene ring). The products are used for mothproofing. W.

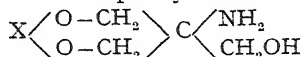
**Sulphonated Hydrocarbon Textile Treating Composition.** E. I. Du Pont de Nemours & Co. U.S.P.2,334,764. A composition for treating textiles consists of 50-90 per cent. of a saturated hydrocarbon having at least 16 C atoms and 50-100 per cent. of an alkali salt of a sulphonic acid obtained by exposing a mixture of the hydrocarbon with sulphur dioxide and chlorine to actinic light until 10-50 per cent. has been converted into the sulphonyl chloride and then hydrolizing the product with an alkali metal hydroxide. C.

**Stearamide Wetting and Softening Bath.** Alrose Chemical Co. U.S.P. 2,334,852. (a) A textile wetting bath comprises a dilute aqueous solution of an amide formed between 1 part of stearic acid and 1.2-2.0 parts of 2-amino-2-ethyl-1:3-propanediol. (b) A textile softening bath comprises a dilute solution of a salt of an amide formed between 1 part of stearic acid and 1.2-2.0 parts of tris-(hydroxymethyl)-aminomethane, NH<sub>2</sub>·C(CH<sub>2</sub>·OH)<sub>3</sub>. C.

**Alkaline Cellulose Solution: Application in Finishing.** Lilienfeld Patents Inc. U.S.P.2,335,126. An intimate suspension of degraded cellulose in caustic alkali is applied to fabric and the degraded cellulose is then coagulated. The degree of degradation is defined as that secured by heating comminuted pulp for viscose with 20 times its weight of 0.5 per cent. hydrochloric acid for 2-12 hours and then washing the solid residue. C.

**Ornamental Plastic Coated Fabric.** M. H. Storch (assignor to H. E. Darr, New York). U.S.P.2,335,222. Textile fabric is impregnated with a plastic material which is arranged to form a thin, flexible, waterproof film on the back and a series of ornamental protuberances on the face, so spaced that the finished fabric is flexible and capable of being stitched on a sewing machine. C.

**Aminodioxane Wetting Agent.** Commercial Solvents Corporation. U.S.P. 2,335,447. The claim is for capillary-active solutions of aminodioxanes,



in which X is cycloalkylidene, alkylidene, substituted cycloalkylidene or the group  $>\text{CR}_1\text{R}_2$ . C.

**Vinyl-Isocyanate Co-polymer Finishing Agent: Application.** E. I. Du Pont de Nemours & Co. U.S.P.2,335,582. Textiles are impregnated with a co-polymer of (a) a vinyl or vinylidene compound and (b) a 1-alkenyl isocyanate or aliphatic  $\alpha$ - $\beta$ -unsaturated acyl isocyanate (or isothiocyanate), and then heated at 70-200° C. C.

**Artificial Leather: Production.** Brown Co. (Berlin, N.H.). U.S.P.2,335,702. A water-laid felted mass of cellulose fibre is passed through a mixture of homogenized starch and rubber latex in which the starch comprises 10-50 per cent. of the total solid matter. C.

**Nitrocellulose-coated Dyed Fabric: Production.** E. I. Du Pont de Nemours & Co. U.S.P.2,335,739. Dyed fabric that would discolour nitrocellulose in contact with it is coated with a resistant mixed cellulose ester of a number of the lower fatty acids, before applying the outer coat of nitrocellulose. C.

**Sulphur Dye Printing Composition.** E. I. Du Pont de Nemours & Co. U.S.P. 2,335,905. The printing composition contains (1) a substantially pure sulphur dye, (2) a film-forming material and (3) a volatile organic solvent for (2). C.

**Plastic Cop Dyeing Tube.** Franklin Process Co. U.S.P.2,336,086. A cop tube for dyeing comprises a framework constructed from a strip of plastic-impregnated and -coated fibre, with longitudinal strands of fibre cemented to the framework. C.

**Textile Oil.** Ontario Research Foundation. U.S.P.2,336,087. The oil comprises 80-95 per cent. of a mineral oil (Saybolt Universal viscosity 50-250 seconds at 100° F.) and 20-5 per cent. of a partial ester of a naphthenic acid and a polyhydric alcohol. C.

**Wool Fabric: Reducing Felting and Shrinkage.** E. Faude (to Kammgarnspinnerei Stöhr & Co. A.-G.). D.R.P. 728,673 of 29/10/1942 (through *Chem. Abs.*, 1944, 38, 494). The fabric is treated with a solution of chlorosulphonic acid in an organic solvent, then with water followed by a dilute aqueous solution of sodium carbonate or ammonium hydroxide. W.

**Hair: Steeping for Use in the Hat, Felt and Similar Industries.** A. Volz and C. Riess (to Chem. Fabr. J. A. Benckiser G.m.b.H.). D.R.P. 731,577 of 14/1/1943 (through *Chem. Abs.*, 1944, 38, 652). The hair is steeped in an aqueous solution of phosphoric acid containing less water than orthophosphoric acid. An alkali, ammonium or amino salt of the acid may be used, in which case a subsequent treatment in dilute nitric acid follows. W.

**Animal Fibres: Improving Felting Properties.** H. Haakh (to I. G. Farbenind, A.-G.). D.R.P.731,871 of 21/1/1943 (through *Chem. Abs.*, 1944, 38, 652). Animal fibres are treated with compounds of multivalent metals and with hydroxyalkylated high-molecular aliphatic hydroxy compounds or hydroxy-alkylated phenols substituted in their nuclei by high-molecular hydrocarbons. W.



## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Controlled Temperature and Humidity Cabinet.** A. Gallenkamp & Co. Ltd. *J. Sci. Instruments*, 1944, 21, 90. A cabinet designed for humidity and temperature tests is built with double walls of asbestolite sheet with insulating material between. The single door hung on heavy hinges closes against a soft gasket by a spring catch. A window is double glazed, and has a small heater between the two sheets of armour-plate glass to prevent condensation. A direct driven fan circulates the air inside the cabinet; the air passes across the working space and returns behind false walls. Heaters and the outlet from a moisture generator are placed between the false walls so that hot moist air is rapidly dispersed throughout the cabinet. Conditions within the cabinet are controlled by a sensitive thermostat and by a hair hygrometer fitted with electric contacts. An end compartment contains a large water tank, moisture generator, fan motor and the electrical controls. A tank is fitted so that soft or distilled water can be used to prevent furring. The water feed to the moisture unit passes through a valve into a constant level tube, the flow being visible through a window in the control panel. The automatic control functions up to 50° C. and just under 100 per cent. R.H. The cabinet can be cooled if necessary, and drying agents used to reduce the humidity. For use above 50° C. the humidity controller has to be removed. To obtain saturation at any temperature the controls are changed so that the thermostat controls the temperature of the moisture unit, and the heaters are permanently off. By this means automatic control is obtained up to 75° C., with a humidity of over 95 per cent. R.H. Higher temperatures can be obtained safely at reduced humidities. C.

**Chain Polymer Fibres: X-Ray Studies.** I. Fankuchen and H. Mark. *J. Applied Physics*, 1944, 15, 364-370. Small-angle scattering of high polymers is studied under (a) scattering of randomly distributed spherical particles, the diameter of which is large as compared with the wave length, (b) scattering of rod-shaped particles, the axes of which are all parallel to the (fibre) axis of the sample, but the centres of which are randomly distributed in space, (c) scattering by spherical particles which are approximately in a closely packed arrangement, and (d) scattering by rod-shaped particles which are closely packed and all parallel to the fibre axis. Observations on highly orientated polymers, such as viscose rayon, cellulose acetate, nylon filaments, and highly stretched rubber bands are discussed. The study of small-angle scattering of orientated chain polymers indicates the existence of periodic or quasi-periodic heterogeneities perpendicular and (in some cases) parallel to the axis of stretch, which are of the order of magnitude between 50 and 300Å and apparently depend upon the conditions under which the fibres are formed. The application of an X-ray microtechnique to the examination of high-polymer fibres is described. A series of microdiagrams taken along a single filament of highly stretched viscose rayon shows rather distinct variations in the degree of orientation from point to point. Series of micro-X-ray diagrams are given showing the changes occurring in the centre and at the surface during the attenuation of a polyamide fibre during drawing. The diagrams show that the process of drawing leads to a homogeneous, crystallised, and highly orientated fibre. C.

**Cottonized Bast Fibre: Determination in Mixtures with Staple Fibre.** O. Viertel. *Kleppig's Textil-Z.*, 1941, 44, 772 (through *Chem. Zentr.*, 1941, ii, 1572-1573 and *Chem. Abstr.*, 1944, 38, 1883<sup>6</sup>). The method of Marschall, in which the staple fibre is dissolved by a mixture of formic acid and zinc chloride, can be carried out quickly, gives sufficiently accurate results and is suitable for practical plant control. The procedure is described in detail. The various grades of staple fibre differ in their rate of solution in the solvent mixture. C.

**Raw and Bleached Groundwood Pulps: Differentiation.** J. H. Graff. *Paper Trade J.*, 1944, 118, TAPPI, 133. In ultra-violet light sheets of unbleached groundwood pulps exhibited fluorescent colours varying from dark purple-drab to dark vinaceous-gray and a sample of bleached groundwood pulp gave a very light "vinaceous-gray" fluorescence. In mixtures, particularly with other types of fibres, this differentiation would be uncertain. The Loften-Merritt



stain, which is prepared by mixing 10 parts of 2 per cent. Malachite green, 20 parts of 1 per cent. fuchsin and 3 parts of 0.05N. hydrochloric acid, can be used for the microscopic differentiation of unbleached and bleached groundwoods. Unbleached groundwood is stained deep violet to pale violet, and commercial peroxide bleached groundwood amethyst violet to light Hortense violet. Tests with mixtures of known composition show that analyses can be made with a small percentage of error. Differences in colour obtained with the Loften-Merritt stain with unbleached and bleached pulps, and differences in the fluorescence of hand-sheets prepared from the pulps persisted after the pulps had been dried and stored for 16 months. C.

**Wool Fibre: Relation between Damage and Cystine Content.** E. Elöd, H. Nowotny and H. Zahn. *Kleppzig's Text. Z.*, 1942, 45, 663-672 (through *Chem. Zentr.*, 1943, 1, 112 and *Chem. Abs.*, 1944, 38, 871). Differently-treated wool yarns were tested for nitrogen, sulphur and cystine contents and resistance to tear. Damage caused by acid pre-treatments do not affect the cystine content; alkali and reducing treatments cause only slight damage, but produce considerable changes in cystine content. In bleaching, the extent of damage is approximately the same as the change in cystine. Cleavage of cystine causes only slight loss in strength, while the splitting of the peptide linkage causes extensive destruction. Most chemical treatments attack both cystine and the peptide linkage. There is no definite relation between cystine content and mechanical injury. W.

**Textile Fibres and Fabrics: Identification and Analysis.** *Dyer*, 1944, 91, 223-226, 265-266, 307-308, 343-344, 395-399. Fibres are classified according to their chemical composition and their suitability for various types of fabrics. Recognised methods are described for identifying fibres (including microscopic examination, appearance in ultra-violet light and reaction to various staining reagents), for determining impurities and finishing agents, and for estimating fibre composition in mixture fabrics. W.

#### (B)—YARNS

**American Rayon Yarns: Deniers and Filament Numbers.** H. R. Mauersberger. *Rayon Textile Monthly*, 1944, 25, 128-130. The author calls attention to the few recent changes in rayons on the American market and provides the following tables: (1) Deniers and filament numbers of rayon yarns now marketed by American producers, (2) Authentic table of deniers and filament numbers of American high-tenacity yarns, and (3) Rayon hosiery yarns produced in the United States. C.

**Rayon Crêpe Yarn: Contraction on Twisting.** Liberty Throwing Co., Inc. *Rayon Textile Monthly*, 1944, 25, 122-123. A previous table is revised. It gives the percentage contraction, resultant denier and yards per lb. consequent on twisting rayon yarns of 50, 75, 100, 125, 150, 200, 300 and 450 denier and the Du Pont Dull No. 7 novelty 200/8/3 yarn, the turns per inch being increased in steps from 15 to high crêpe twists. Most of the data are based on actual tests. C.

**Warp and Weft from Cloth: Testing.** Ethel L. Phelps, Helen M. Ward, Delphine van Houten and Barbara Bailey. *Rayon Textile Monthly*, 1944, 25, 125-127. A report is given of a direct comparison of results obtained for count, twist, breaking load and extension at break of warp and weft yarns (a) isolated for a sufficient length in the cloth just before fixing in the testing instrument, and (b) pulled down from the cloth and allowed to lie for at least 12 hours before testing. Method (a) conforms with Specification D39 (1939) of the American Society of Testing Materials, a revision of which is under consideration and gave rise to the investigation. The cloths examined were six cotton twill jeans, five cotton suitings and three weights of wool serge. The results are summarised in tables. *Count.* Isolating the yarns just before testing (method a) seems to give slightly higher values (especially with the jeans) than previous pulling down of the cloth (method b), but the differences are statistically significant in only a few instances. It made no difference to the results whether the 10-inch lengths were cut by the experienced worker against a ruler or obtained on a twist tester with the yarn under tension equivalent to 156 gm. divided by the count. *Twist.* Method a gave slightly higher values than b, especially in wefts, but again the differences were statistically significant in only a few instances. *Breaking load.* No significant differences between the

(a) and (b) results were found for cotton warps and wefts or for wool warps, but wool wefts gave significantly lower strength figures by method (b). *Extension at break*. Most of the results were significantly lower by method (b). On the whole, therefore, pulling down the cloth some hours before testing the yarns is not recommended. C.

**Laboratory Conditioning Apparatus.** V. S. Federov and E. G. Türk-Eigess. *Khlopchatobumazh. Prom.*, 1940, 10, No. 11-12, 25-26 (through *Chem. Zentr.*, 1941, ii, 2513 and *Chem. Abstr.*, 1944, 38, 1884<sup>2</sup>). The apparatus is a hermetically closed box in which the humidity desired can be brought about quickly and can be varied from 0-100 per cent. The apparatus is shown and described in detail. A table lists various chemicals which are used to produce the required degree of humidity. C.

#### (C)—FABRICS

**Coated Fabrics: Water Vapour Permeability.** J. T. Stearn and A. S. Cooper, Jr. *Amer. Dyes. Rept.*, 1944, 33, 150-156. The water-vapour permeability of coated fabrics is discussed. Coated fabrics may be obtained that transmit some water vapour though preventing the passage of liquid water even under hydrostatic pressure up to 50 cm. It is suggested that water-vapour transmission through the coated fabric must take place by absorption by the coating material as well as the fibre on the high-humidity side and evaporation from the other surface exposed to lower humidity. Measurements of the water-vapour permeability of coated fabrics are reported. Details are given of the method. A permeability cup is used with a saturated atmosphere over water in the cup and a surrounding atmosphere at 70° F. and 65 per cent. R.H. Possibilities of errors due to (a) lowering of the water level in the test cup, (b) lack of equilibrium conditions before the first weighing, (c) varying tautness of the cloth, (d) edge leakage at the seal, (e) changes in barometric pressure during the test, and (f) humidity gradients in and outside the coated cloth are discussed. The results of measurements on poplin coated with ethylcellulose and with a vinyl resin, which before coating had been given a water-repellent finish with Zelan, on desized poplin, and on commercially finished poplin and print cloth are tabulated. The data show that the coatings, which were sufficient to prevent the passage of liquid water under a head of 50 cm. pressure, reduced the water-vapour permeability of the poplin only 10 to 35 per cent., the cellulose derivative coating giving a higher permeability than the vinyl resin coating. C.

**Dyed Cotton Fabrics: Deterioration by Light.** F. I. Sadov and E. D. Gruzdeva. *Tekstil'naya Prom.*, 1941, No. 1, 48-52 (through *Khim. Referat. Zhur.*, 1941, 4, No. 9, 125 and *Chem. Abstr.*, 1944, 38, 1645<sup>9</sup>). Samples of cotton fabrics dyed with Gold-Yellow Bg.K Indigosol lost up to 84 per cent. of their initial strength on 3 months' insolation, and samples dyed with Vat Gold-Yellow ZhKh dyes or with Solanthrene Orange NR dyes lost up to 75 per cent. Under the same conditions Thioindigo Ruby Zh and Vat Red KKh had almost no effect on the photo-chemical decomposition of cellulose. Vat Blue and Chloroindanthrene Light Blue had a protective effect on the fabric. Dyes containing more heterocyclic nitrogen have a greater protective effect against light. C.

**Plastics Yarn Fabrics: Defects.** *Rayon Textile Monthly*, 1944, 25, 134-135. A dozen illustrations are given of typical defects in fabrics woven from plastics yarns (not specified), with suggestions for their avoidance. C.

**Sulphur Dyed Textile Materials: Accelerated Ageing Test.** American Association of Textile Chemists and Colorists. *Amer. Dyes. Rept.*, 1944, 33, 145-146. An accelerated ageing test for textile materials dyed with sulphur dyes is carried out in a conventional laboratory drying oven, uniformly heated and controlled to  $\pm 2^\circ \text{C}$ ., or in a steam ager equipped with controls for uniform steam flow and temperature. The oven test is carried on for six hours at  $135 \pm 2^\circ \text{C}$ . At the end of 1, 2, 3, 4 and 5 hours the ports or vents are closed and 20 c.c. of water added for each cubic foot of oven capacity. The vents are kept closed for five minutes, then opened and circulation resumed for the rest of the period. As an alternative the test specimens may be removed from the oven at the end of each hour and thoroughly humidified in an atmosphere of steam, then replaced in the oven. At the end of the six hours the specimens are removed

from the oven and placed in a conditioning room. In the steam ager test the specimens may be suspended while ageing, or may be tacked on frames, which are then placed in the ager, pyramid style, with the bottom baffle functioning as a support. The specimens are aged for 8 hours with saturated steam at 15 lb. pressure, or for 16 hours at 7½ lb. pressure. The samples are then removed and placed in a conditioning room. Breaking load tests are used to determine the degree of deterioration, although cuprammonium fluidity may be used if desired. C.

**Fabrics: Testing of Handle.** *A.S.T.M. Bull.*, 1944, No. 126, 43-45. Details are given of proposed methods for the evaluation of properties related to the handle of soft-finished woven fabrics. The tests involve the use of the Planoflex apparatus for measuring flexibility by means of the distortion angle, the Friction Meter for measuring surface smoothness in terms of the coefficient of kinetic friction, and the Compression Meter for measuring compressibility. A combination of the measurements made on the Planoflex apparatus and the Compression Meter gives a measure of the fullness of a woven fabric. C.

**Finished Fabrics: Stiffness; Effect of Humidity.** Lelia J. Winn and E. R. Schwartz. *Amer. Dyes. Rept.*, 1941, 30, 226-230, 238. Samples of a rayon fabric, tag cloth, mulle sheer and glazed chintz were tested at different humidities on the Drapeometer. Results are given in tables and in graphs showing chord length plotted against vertical distance from top. They show that stiffness increases as the relative humidity is lowered. The use of the Drapeometer is explained. In tests with this device a rectangular sample is hung with its top short side around a drape disc and measurements are made of the contour of the specimen at various distances from the top. C.

**Industrial and Protective Clothing: Standardization.** C. Kendall and H. B. Duffus. *Industrial Standardization*, 1944, 15, 25-28. The American Standards Association has published specifications for women's industrial clothing and specifications for protective occupational (safety) clothing. The former include specifications for aprons, jackets, skirts, wrap-around and coat-style dresses, slacks, dungarees, overalls and coveralls. A large range of sizes, with 1½ in. gradations in size, is specified, except in the case of aprons for which three or four sizes are specified according to type. Slacks, dungarees, etc., are to be made in short, regular and long lengths. Selection of the suitable type of clothing to be worn for a specific job remains the responsibility of the plant management. The standards make no attempt to specify the type of job for which the garment is intended. The safety clothing specifications relate to leather aprons, cape sleeves, bibs and leggings for use in welding operations, sand blasting, etc. These garments are to be made from chrome-tanned leather which remains soft and pliable under heat and is thick enough to prevent sparks from burning through. The standard for leather aprons provides for steel reinforcement when needed. C.

**Mildew-resistant Fabrics: Soil-suspension Test.** Margaret S. Furry. *Amer. Soc. Testing Materials: Symposium on Mildew Resistance*, 1943, p. 15-22. In the soil-suspension method of testing the mildew resistance of fabrics, sample strips are first washed under a gentle flow of running water for 24 hours, then immersed for 30 min. in a thin suspension containing 70 g. of soil to 250 ml. of distilled water, and then placed on glass cloth in a culture bottle containing a suitable culture medium and incubated at approximately 28° C. for 10 to 14 days. Changes in breaking load are determined. The results of tests using different types of soil are discussed. An untreated cotton duck inoculated with a soil composted from one-third sandy loam field soil, one-third well-rotted manure, and one-third muck soil was completely rotted within 14 days of incubation. Results are given of tests of fabrics treated with copper compounds, using three different culture media and glass cloth, soil-cotton-soil wicks and other types of supports for the samples. A method of evaluating the effectiveness of treatments in terms of a standard, e.g. cotton osnaburg treated with copper naphthenate so that it contains about 1 per cent. copper by weight on the fabric is explained. Results obtained by the soil suspension test are compared with results obtained by the pure culture test for mildew resistance using *Chaetomium globosum* as the inoculum. The soil-suspension method appears to be a more severe test and in addition differentiates between

different treatments. It shows that, as the copper content decreases, copper naphthenate gives better protection against rotting than a copper oleate and resinate mixture. C.

**Mildew-resistant Fabrics: Soil-suspension Test.** Margaret S. Furry and Marian Zametkin. *Amer. Dyes Rept.*, 1943, 32, 395-398. Details are given of a method of testing the effectiveness of mildew-resistant treatments on fabrics for outdoor use in which samples of the treated fabric are inoculated by immersion in a soil suspension and then incubated under controlled temperature and humidity conditions. The fabric is first washed under running water for 24 hours and then cut into strips which are immersed for 30 min. in a suspension of soil containing 70 g. of soil to 250 ml. of distilled water. Soil composted from one-third sandy loam field soil, one-third well-rotted manure, and one-third muck soil is used. Incubation is carried out in a culture bottle containing a suitable liquid culture medium, the sample being supported on a strip of glass fabric which also serves as a wick to draw up the culture medium. The effectiveness of the treatment is determined from the breaking strength of the inoculated test strips in comparison with that of the original treated fabric. Results can also be evaluated in terms of a standard. Notes are given on microorganisms which have been isolated from soil and their action on cotton fabric. Applications of the soil suspension test are discussed and results of tests of various treatments are tabulated. Treatments with copper naphthenate, cuprammonium hydroxide, lead acetate with potassium dichromate, and cutch or osage orange with copper sulphate and potassium dichromate were found to be effective on cotton osnaburg. C.

**Mildew- and Rot-resistant Textiles: Testing.** H. D. Barker, G. A. Greathouse and P. B. Marsh. *A.S.T.M. Bull.*, 1944, No. 126, 32-34 and *A.S.T.M. Symposium on Mildew Resistance*, 1943, p. 1-4. The problem of standardizing test methods for mildew- and rot-resistant treatments of textiles is critically discussed. It is pointed out that preventive treatments and appropriate methods should take into consideration expected service conditions, types of fabrics, fungicides that are available or practical to apply, supplementary waterproofing or flameproofing materials and other special considerations. The importance of considering expected service conditions is illustrated by a study of the inter-relationship of the various factors that may be involved in fabric deterioration. Unknown and uncontrollable factors in soil burial tests and differences in behaviour of different soils are discussed, and the opinion is expressed that in spite of their shortcomings soil contact tests have an appropriate place in the testing of treated fabrics that are expected to be exposed to soil contacts. It is suggested that in devising practical test procedures there arises a need for two distinct types of tests—evaluation tests and acceptance tests. Evaluation tests should determine (1) whether the proposed protective agent has fungicidal or fungistatic properties, (2) the degree of resistance the proposed protective agent has to leaching, photochemical action, ionic adsorption, and other weathering agencies that eventually reduce the concentration on the fabric to a value that will permit growth of deleterious micro-organisms, and (3) the amount of the protective agent that must be applied to the fabric to assure practical service life. Acceptance tests should be rapid and of a routine nature, and be capable of detecting spotty application or ascertaining that the kind and amount of desired preventive treatments have been applied. They should be sufficiently severe properly to rank commercial treatments with excesses of the treating agent. The possibility of substituting chemical for biological tests is mentioned. C.

#### (D)—OTHER MATERIALS

**Gauges: Use in Quality Control.** L. H. C. Tippet. *Engineer*, 1944, 177, 481-483. Quality control of mass-produced articles often depends on making precise measurements (e.g. of diameter) on small, representative samples. In some circumstances it would be more convenient to apply a gauge, but this requires a far larger sample. It is now shown that by setting the gauge to give a larger fraction of "defectives" than the usual "passing out" gauges, inspection work can in some circumstances be considerably simplified; for example, gauging on 20 articles may give at least as good control of the average, or variability, or both, as actual measurements on 10 articles. C.

**Paper and Paperboard: Determination of Wet Tensile Breaking Strength.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1944, 118, TAPPI, 143-144. A revision of TAPPI Tentative Standard T 456 m-42 is presented. The test is made in accordance with the procedure given in TAPPI Standard T 404-m. The Finch device, which is briefly described, is used for wetting tissue papers, paper towels, and other papers that are difficult to handle when wet. Materials that can be handled without difficulty when wet, and paperboards, are immersed in a shallow dish of liquid for a predetermined time. Ultimate wet strength is defined as the strength of the material after complete saturation with a liquid, and normal wet strength as the strength of the material after it has been wetted to an extent comparable with conditions of normal use. C.

## 7.—LAUNDERING AND DRY-CLEANING.

### (A)—CLEANING

**Clothing: Hot Air Disinfection.** W. Schmidt. *Z. Hyg. u. Infektionskr.*, 1943, 124, 606-614 (through *Bull. Hygiene*, 1944, 19, 309). Steam damages fabrics and particularly leather and furs; hot air, if efficient, would therefore be preferable. Two forms of apparatus are on the market in Germany, both intended to work at a temperature of about 100° C., and designed therefore to destroy only non-sporing micro-organisms. One is an oven in which clothing, etc., can be placed, and the other an oil-burning stove for raising the temperature of an entire room to this point. Both contrivances have been tested up to a temperature of 110° C., with bacteria dried on pieces of linen as test objects. Although they destroyed cultures of streptococci, staphylococci and *Bact. coli*, they failed to sterilize streptococcal or staphylococcal pus or faeces. It therefore appears that such treatment is likely to be unreliable for disinfecting naturally infected materials. C.

**Soap Solutions: pH and Detergent Effect.** M. Dole. *Amer. Dyes Rept.*, 1941, 30, 231-238. The significance of pH, electrometric and colorimetric methods of measuring pH, and glass electrodes for pH measurements are discussed. Curves are given showing the effects of alkaline builders such as sodium hydroxide, phosphate, carbonate, and borate on the pH of soap solutions, the variation in surface tension and in contact angle on paraffin of sodium oleate solutions with concentration and pH, and the variation in detergent power (as measured by changes in brightness of samples after washing) with pH of soap solutions containing builders. Explanations of the observed variations are suggested. The data indicate a definite relationship between pH and detergency, and that the total alkaline capacity of a solution, which can be measured only by titration, is also important. C.

**Dry Cleaning: Odours and Other Troubles.** P. C. Trimble. *Starchroom Ldy. J.*, 1944, May, 78, 82, 84, 86. A collection of springtime notes on avoiding odours in cleaned garments, the use of puff irons in finishing furniture covers, cleaning of suede jackets, the tumbling of woollens after spotting, production efficiency, leaking gaskets in distillation plant and the dry cleaning of greasy table linen. La.

**Dry Cleaning Solvent Mixtures: Separation Methods.** O. C. Cessna. *Ldy. & Dry Cleaning J. of Canada*, 1944, June, 16, 18. Impure solvent to be used in a dry cleaning machine may need filtration, distillation or decantation before or after distillation, according to the nature of the impurities. La.

**Dry Cleaning: Problem of Shrinkage.** *Ldy. Age*, 1944, May, 52, 54. The four primary factors affecting the shrinkage of woollen garments in dry cleaning are moisture, mechanical action, heat and alkali. La.

### PATENTS

**Peptone: Use for Washing Textiles.** A. Nordfeldt (Strangnas, Sweden). B.P. 561,542 of 20/3/1942:24/5/1944 (Conv. 4/3/1941). Textile materials can be washed with aqueous solutions of peptone. Such solutions have a cleaning action similar to that of soap solutions and are free from the drawbacks arising from the presence of free alkali and fatty acid in soap solutions. For cleaning cotton, linen, rayon and similar fabrics, it is advisable to employ peptonized water for a preliminary washing, by which a considerable portion of the dirt is

washed out, and a subsequent treatment with soap or other alkaline preparations which are then needed only in reduced quantity. C.

**Improvements in or Relating to Washing Machines.** British Thomson-Houston Co. Ltd. B.P.562,372. Conv. (U.S.) 24/7/41. Appl. (U.K.) 22/7/42. Acc. (U.K.) 29/6/44. The invention relates to washing machines of the type in which clothes are washed and centrifugally dried in a rotatable clothes receptacle, the object being to provide an improved construction for controlling the water supply level. One typical machine fitted with this device contains a rotatable clothes receptacle, from which the liquor overflows into the casing, a valve-controlled water supply conduit discharging into the receptacle, a hydraulic pressure operator for closing the valve, a bleeder conduit leading from the water supply conduit to the hydraulic operator, a by-pass conduit leading from the bleeder conduit for relieving the pressure in the hydraulic operator, and means responsive to the liquid level in the casing for closing the by-pass conduit. Another machine of the same type is provided with a valve biased to its closed position, a latch for holding the valve in the open position, and a hydraulic pressure operator for releasing the latch. La.

**Carbohydrate and Synthetic Surface-active Agent Washing Compounds.** J. Nüsslein and K. Pauser (Frankfort-on-Main); vested in the U.S. Alien Property Custodian). U.S.P.2,335,194. The washing compounds claimed comprise 90-70 parts of water-soluble derivatives of cellulose, starch and other polyoses with ether-like bound hydrocarbon radicals substituted by hydrophilic groups, and 10-30 parts of a non-hydrolyzing surface-active agent (selected from a wide range) the amount of which would not of itself be sufficient to effect washing. C.

## 8—BUILDING AND ENGINEERING

### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Metals: Inspection and Testing.** J. E. Garside. *Engineer*, 1944, 177, 459-462, 478-9, 498-500. A useful summary is given of methods for the inspection of metallic materials under the headings:—(1) *Chemical composition*: (a) examination of colour, spark, magnetic and density tests, spectroscopy and acoustical tests; (b) chemical and electrographic analysis. (2) *Mechanical properties*: (a) hardness; (b) tensile, transverse, torsion, bending, impact and fatigue tests; (c) cupping tests; (d) damping capacity tests; (e) static or hydraulic tests. (3) *Determination of wall thickness and coating thickness*: Magnetic and electrical conductivity methods. (4) *Detection of surface defects*: (a) immersion tests, (b) fluorescence methods, (c) ferrographic method. (5) *Detection of unsound material*: (a) density, magnetic, conductivity and acoustical methods, (b) radiology. (6) *Determination of structure*: (a) etching, sulphur and phosphorus printing, detection of oxide inclusions, examination of fracture, and (b) microscopic and X-ray diffraction methods. The following tables are included: (1) Physical test data for irons, steels, nickel alloys, brass, bronzes, copper, aluminium, magnesium alloy, lead and solders. (2) Methods for determining Al, C, Cr, Pb, Mn, Mo, Ni, P, Si and S and the precision attainable. (3) Chemical and spot tests for the same materials as in Table 1. C.

**Wood: Effect of Heat on Strength.** P. H. Sulzberger (Forest Products Research Laboratory). *Engineering*, 1944, 157, 478. A preliminary report is given of an investigation of the effect of temperature ( $-10$  to  $+60^{\circ}\text{C.}$ ) on the mechanical properties of certain timbers and plywood at a moisture content of 15 per cent. Strength and most other properties investigated decreased with increased temperature. Toughness appeared to increase in some species and the deflection at failure in static bending increased considerably in all species. C.

**Wood Products: Uses.** "Times" Trade & Engineering, 1944, 55, May, p. 10 and 13. (1) The varied uses of wood, the need for future economy in use, the disposal of wood waste, the chemistry of wood, wood cellulose pulps for the paper and rayon industries, and the use of lignin as a plastic are briefly discussed. (2) Tests have shown that lignin extract, an abundant by-product of the pulp and paper industry, can be used in road construction and that it adds substantially to the bearing capacity of a gravel surface and to its resistance to shearing. The lignin extract is mixed with gravel and clay and the mixture,

spread in layers not exceeding three inches is consolidated by means of multiple-tyre rollers. For an impervious and good wearing surface the mat thus obtained must be covered with asphalt or tar. The use of the lignin extract enables savings in gravel and asphalt to be made. C.

**Alloys: Resistance to High-Temperature Steam.** I. A. Rohrig, R. M. Van Duzer and C. H. Fellows. *Amer. Soc. Mechanical Engineers, Preprint*, Nov.-Dec., 1943, 12 pp. (through *Nickel Bull.*, 1944, 17, 69-74). Specimens of various alloys were exposed, under operating conditions, inside a high-temperature steam line, being subjected to a steam atmosphere of 380 lb. per sq. in. at temperatures of 925° and 1100° F. (495° and 595° C.). Periods of exposure varied from 4,000 to 16,000 hours. Periodic determinations were made of changes in weight, hardness and structure. Details are given of the procedure and the superheater and pipe system used, and results are presented in tables. Charts showing penetration-corrosion, and photo-micrographs are also given. The results show that, in general, ferrous alloys containing high percentages of chromium alone are corrosion-resistant in steam at 1100° F. Ferrous alloys containing high percentages of chromium and nickel are also resistant at 1100° F. The non-ferrous materials tested were not so resistant to high-temperature steam as the high-alloy ferrous materials. At 1100° F. significant differences were observed between the rates of corrosion of carbon steels and of medium- or low-alloy steels: at 925° F. only a slight difference was found. At both temperatures many steels of a relatively low alloy content compare favourably in corrosion-resisting quality with steels in the medium-alloy group (e.g. 0.5 per cent. molybdenum steel with 5 per cent. chromium steel). The ability of a material to retain an adherent protective scale is an important factor in determining its resistance to attack by high temperature steam. Loss in weight of carbon steel under exposure to steam at 1100° F. continues for prolonged periods at a high rate, but the corrosion rate of alloyed materials slows down with increasing time of exposure. C.

**Alloy Steels: Resistance to High-Temperature Steam.** G. A. Hawkins, J. T. Agnew and H. L. Solberg. *Amer. Soc. Mechanical Engineers, Preprint* 10, Nov.-Dec., 1943, 4 pp. (through *Nickel Bull.*, 1944, 17, 68-69). Specimens of steel with sand-blasted surfaces were exposed to steam in an unstressed condition and the loss in weight determined. The results, together with results of previous investigations, show that all the steels tested, with the exception of the 25/20, 25/15/2, 21 per cent. chromium and 27 per cent. chromium specimens start to corrode rapidly at some temperature below 1675° F. (912° C.). After the break occurs, the rise in corrosion rate is much more rapid for the steel containing 12 per cent. chromium and the 18/8 stainless steel than for steels containing less chromium. The temperature at which rapid corrosion begins rises with the chromium content. Analysis of various layers of scale formed on chromium-molybdenum steels indicates that resistance to steam-oxidation is due to a thin and very dense tightly-adhering inner layer of scale, and a dense middle layer, which contains a higher concentration of the alloying elements than is present in the basis steel. The alloying elements diffuse outwards and the oxygen diffuses inwards, the combined effect causing the formation of the dense protective inner layer. The results confirm the conclusion drawn in earlier investigations, that the chromium content of a steel is a major factor in controlling its resistance to attack by high-temperature steam. Some empirical equations are presented for use in computing the amount of corrosion produced for the various steels in 500 hours at temperatures within the test range. C.

**Aluminium, Zinc and Zinc Alloy: Reactivity with Electrolytes.** J. V. Petrocelli and A. Phillips. *Electrochem. Soc. Preprint*, 1944, 85, No. 6, 51-70. An account is given of a study of the electrochemical behaviour of aluminium, zinc, and a zinc base die-casting alloy and its constituents. The changes with time of the electrode potentials were recorded and polarization measurements were carried out in solutions representing those used in electrodeposition practice. The corrosion of aluminium, zinc, and their alloys appear to be largely electrochemical in nature. The corrosion current on pure aluminium and pure zinc was determined by a cathodic polarization method and checked by weight loss measurements. Many couples of the individual metals concerned were



studied and the interaction currents determined. Polarization studies on composite electrodes showed how the current densities could be distributed on heterogeneous surfaces. C.

**Chemical Plant Cements: Properties and Applications.** R. Ward. *Industrial Chemist*, 1944, 20, 71-74, 201-204, 253-256, 283-288. A useful review is given of the various types of hydraulic cements, acid-resisting cements based on soluble silicates, rubber latex and resin cements, and lutes used in the construction of chemical plant, their properties, mixing and working conditions. C.

**Electrical Insulating Materials: Properties.** T. F. Wall. *Engineering*, 1944, 157, 482-483. The molecular structure of insulating materials is discussed and the properties of various synthetic materials are compared with those of natural products, such as paraffin, amber, wood, cotton, silk and rubber. The properties and uses of polyethylene, polystyrene (Trolitul), polyvinyl chloride (Igelit), polymerised iso-butylene (Oppanol), synthetic rubbers (Buna and Perbuna), and polyamide materials (Perlonseide) are briefly described. C.

**Metals: Corrosion Mechanism.** R. M. Burns. *A.S.T.M. Bull.*, 1944, No. 126, 17-20. A discussion of the electrochemical nature of corrosion, the application of electromotive force series, the formation of protective films, the influence of electrode polarization, the practical application of polarization curves, and the electrolytic nature of oxidation and tarnish. C.

**Metals: Galvanic Corrosion.** R. H. Brown. *A.S.T.M. Bull.*, 1944, No. 126, 21-26. The nature of galvanic corrosion is explained and its dependence on such factors as potential difference, polarization, current distribution, and resistance of both the corrosive environment and the metallic circuit, is studied. Methods of reducing galvanic corrosion by (1) more careful selection of alloys, (2) insulation of contacting alloys, (3) painting, and (4) cathodic protection are briefly discussed. C.

**Reinforced Plastics: Impact Strength.** P. M. Field. *Modern Plastics*, 1944, 21, No. 8, 123-125, 162. Tests were made on notched Izod specimens of phenol-formaldehyde and other resin materials reinforced with cotton, paper, asbestos, wood or glass, at room, high ( $+160^{\circ}\text{F.}$ ) and low ( $-70^{\circ}\text{F.}$ ) temperatures. Results are shown in tables and graphs. The strongest material tested was a glass- and cotton-reinforced phenolic resin which had an impact strength at room temperature of 22.5 and 18.0 ft. lb. per in. for face and edgewise impact, respectively. This exceeds the value for cast magnesium (9.5) and cast aluminium alloy (4.3), and is of the same order of magnitude as extruded magnesium (21.0) and rolled 24ST aluminium alloy (20). The next best materials were a moulded cord-reinforced phenolic and a low-pressure fabric-base phenolic. A phenol-formaldehyde resin reinforced with Mitscherlich (spruce sulphite) paper exhibited very poor edgewise strength. Investigations of the relationship between single blow and repeated blow impact strength have shown that for some thermoplastic materials, the impact fatigue strength is as low as 3.6 per cent. of the single-blow impact strength. For reinforced phenolic materials the value is approximately 50 per cent. For most of the materials the strength is greater at elevated temperature and lower at reduced temperature, but this trend is reversed in the case of glass-reinforced material. All laminated materials are better under facewise than under edgewise impact. C.

**Repair of Machinery.** W. F. Schaphorst. *Amer. Dyestuffs Reporter*, 1943, 32, 378. It is stated that it is unlawful to repair patented parts of machinery without permission of the patentee. La.

**Unusual Maintenance.** J. G. Berger. *Starchroom Ldy. J.*, 1944, Jan. 15th, 70. Unusual maintenance jobs include repair of damaged wood or metal parts (the latter by welding or spraying) washing machines, hydros, electric wiring and so on. Twelve points on boiler operation and nine on generator sets are enumerated. Other plant mentioned includes water heaters, reclaimers, traps, valves, pipes, electric motors and the importance of regular inspection and keeping of records is emphasised. La.

**Motor Maintenance.** R. R. Stodz and L. E. Markle. *Starchroom Ldy. J.*, 1944, March 15th, 66, 68, 70, etc. An article on motor maintenance by two members of the staff of the Westinghouse Electric & Manufacturing Co.



Starters and controllers should always be correctly matched to the motors and machines they control. The article is illustrated with a number of photographs showing steps in the maintenance and repair of contactors and switchgear and a chart for checking starter trouble is given. Contact pressure, worn and burnt contacts, lubrication, shunts, coils, dirt, dashpots and so on are discussed. La.

#### (C)—STEAM RAISING AND POWER SUPPLY

**Water Tube Boilers: Heat-transfer Calculations.** E. F. Lype. *Mechanical Engineering*, 1944, 66, 254-256. Two charts from which the value of the coefficient of heat transfer from gas to tube wall can be obtained for either staggered or in-line tube arrangements, and for any given value of the tube spacing, tube diameter, gas velocity, and mean film temperature, are presented and their use is illustrated by examples. C.

**Fuel Efficiency.** Ministry of Fuel and Power: Fuel Efficiency Committee. *Fuel Efficiency Bull.*, Nos. 25-30, 1943-1944. These bulletins deal with steam for process and heating, peak steam demands, control of air for combustion, flash steam and vapour recovery, industrial use of compressed air, and unorthodox use of economisers. W.

**Water Treatment.** S. H. Wellington. *Text. J. Australia*, 1944, 18, 460-466. Types of water, methods of treatment, and uses for steam raising, and for scouring, bleaching, dyeing and effluent treatment are discussed, with particular reference to the Australian textile industry. W.

**Smoke Abatement.** N. T. Pef. *Ldy. Age*, 1944, March, 55. Smoke abatement will be increasingly important after the war, although all causes of this trouble are not known. Among those which can be dealt with are deficiency of air, improper air mixing, forced firing, condition of grates and furnaces, kind of coal, and suggestions for their correction is given. La.

**Packings and Efficiency.** F. D. Mosher. *Ldy. Age*, 1944, March, 60. The handling, preparation of packing and work, and general installation of packings of various kinds are discussed together with the removal of old material and inferences to be drawn from its condition, e.g. distortion may mean lack of alignment and so on. La.

**Gasket Maintenance.** F. D. Mosher. *Ldy. Age*, 1944, Feb., 43. Wherever there is piping carrying fluids, gaskets and packing are important maintenance items. The effects of bad or improper packing and the choice of suitable packings for various purposes are considered. La.

**Burning Low Grade Fuel.** F. D. Mosher. *Ldy. Age*, 1944, April, 51. In considering the efficient burning of low grade fuel the following aspects are discussed: Overfire air jets to avoid smoke; air preheating; wetting and mixing; firing technique; installation of forced draught; ash removal; keeping fuel bed cool; automatic stokers. La.

#### (D)—POWER TRANSMISSION

**Belt Dressings: Composition and Use.** E. E. Halls. *Industrial Chemist*, 1944, 20, 241-244. Types of belts and their cleaning and maintenance are discussed. The characteristics required in a belt dressing are described. Formulae for various dressing compounds are given together with brief notes on the methods of preparation and application. C.

**Wire Ropes: Construction and Mechanical Properties.** N. Whincup. *Engineer*, 1944, 177, 405-6, 426-7. A concise account is given of the construction of various types of wire ropes (including crane and hoist ropes), the minimum sizes of pulleys and drums commensurate with the bending stresses, what to specify when purchasing a wire rope, and factors of safety. C.

**Transmission Belt Dressings: Composition.** K. Micksch. *Gummi-Ztg.*, 1941, 55, 326-327 (through *Chem. Zentr.*, 1941, ii, 838 and *Chem. Abstr.*, 1944, 38, 1814<sup>6</sup>). A review and discussion of the proper treatment and upkeep of transmission belts. Belt dressings usually are composed of train oil, tallow or degreas. Mineral oils or fat oils (olive oil, castor oil, etc.) also may be added, but not over 5 per cent. should be present. A high rosin content should be regarded as an adulteration. C.

**Group or Individual Drive.** J. G. Berger. *Starchroom Ldy. J.*, 1941, October 15th, 102, 104. A discussion of the relative merits of group and individual drives and the factors to be considered when planning a changeover from either method to the other. La.

(F)—LIGHTING

**Cotton Mills: Lighting.** J. W. Howell. *Trans. Illum. Eng. Soc.* (London), 1943, 8, 75-96. The various processes carried out in cotton mills and their lighting requirements, and suitable lighting systems, are discussed. For the preliminary processes 6 to 10 ft. c. are required. Spinning, twisting, fancy doubling, winding, slashing and dressing, packing, weaving (grey cloth) and inspection (grey cloth) require 10 to 15 ft. c., warping, weaving (light colours), and mending require 15 to 25 ft. c., and weaving (dark colours) and perching, 25 to 50 ft. c. Installation costs, the maintenance of lighting equipment, the influence of walls, windows and ceilings, and the desirability of systematic lamp replacement are discussed. Results are given of tests showing increases in output, quality and profits secured by improvements of lighting in beam warping and weaving processes. C.

**Dufton Window Scale: Application.** A. F. Dufton. *Trans. Illum. Eng. Soc.* (London), 1943, 8, 61. The problem of estimating the area of window necessary to provide a given daylight-factor at a point, on the working plane, opposite the centre of the window, may be resolved in terms of the daylight factor per foot width of window, a quantity which is readily determined from a drawing. The method is briefly explained and a scale designed for use in such determinations is shown. C.

**Fluorescent Lighting Fixtures: Design.** *Modern Plastics*, 1944, 21, No. 8, 98-100. The rapid growth in the use of fluorescent lighting in industrial and commercial establishments is briefly discussed and it is pointed out that for domestic and some commercial uses modifications in colour and improvements in the design of fixtures are desirable. Fixtures incorporating (1) louvres of extruded cellulose acetate strips, (2) corrugated cellulose acetate sheet resting on glass rods slipped through moulded acetate rings, and (3) interwoven cellulose acetate strips attached to a frame fabricated of extruded acetate moulding are discussed. Photographs and blue prints are given. The advantages of cellulose acetate for such constructions are pointed out. C.

**Lighting Code Proposals.** H. C. Weston. *Trans. Illum. Eng. Soc.* (London), 1943, 8, 17-39. An attempt is made to apply some of the results of recent research on the relation between illumination and size of work, and the effect of brightness contrast, to the reconstruction of the Illuminating Engineering Society's code of illumination values on a more satisfactory basis. Satisfactory illumination and considerations governing the selection of a performance standard are discussed and it is suggested that recommended illuminations should be adequate to permit a performance of visual tasks which is of the order of 90 per cent. of the maximum possible at any higher illumination. This is subject to a minimum recommended value, applicable however crude or easy the visual task. Otherwise code illuminations are those necessary on the work itself, though their effectiveness is conditional upon general illumination to secure a suitable ratio of environmental to work brightness. It is suggested that the lower limit of the range could remain at its present value of 2 ft. c. The upper limit and the division of the range are discussed, and the need for a logarithmic scale is pointed out. A range consisting of thirteen effectively different illuminations, forming a series whose common ratio is 1.414 is presented. It may be divided into six sub-ranges, whose limits have a common ratio of 2, if it is desired to classify tasks on a broader basis. These illuminations are related to the size of detail involved in the visual task, and apply only when the contrast inherent in the work is the best possible. Correction for other conditions of contrast is discussed. A formula for computing the working illumination required and a graph from which the required illumination can be read are given. The agreement to be expected between the computed illuminations and current "good practice," and the application of the code are discussed. A report is given of discussions of this paper. C.

**Lighting Systems: Numerical Assessment of Effectiveness.** (1) W. D. Wright. (2) K. J. W. Craik. (3) Sheila J. Macpherson. (4) W. S. Stiles.

*Trans. Illum. Eng. Soc.* (London), 1943, 8, 43-58. Short papers are presented on the numerical assessment of the effectiveness of lighting by methods based on (1) subjective brightness measurements, (2) visual acuity, (3) blinking rates and (4) visual thresholds, and a report is given of a discussion of the papers. C.

**Non-uniform Sky; Illumination from —.** P. Moon and D. E. Spencer. *Illum. Eng. Soc. Trans.* (N.Y.), 1942, 37, 707-726 (through *Building Sci. Abstr.*, 1943, 16, 143). Previous investigations of the illumination from the skies have been based on uniformity of sky brightness, which never occurs in nature. Such an assumption leads to large errors in calculations of the illumination of interiors. Expressions and curves for the calculation of daylight illumination from overcast skies have been developed by the authors which take into account the variation in sky brightness obtained experimentally. Formulae and curves are given also for the outdoor illumination on horizontal, vertical and sloping surfaces. Practical conclusions are drawn relating to the size of windows and depth of rooms of importance for improved uniformity of natural lighting in buildings. C.

#### (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Air: Ultra-violet Disinfection.** A. Hollaender. *Amer. J. Public Health*, 1943, 33, 980-984 (through *Bull. Hygiene*, 1944, 19, 308). The use of ultra-violet light for the control of airborne infection is critically reviewed. The development of low-pressure mercury vapour lamps with glass or quartz envelopes which emit about 80 per cent. of their radiation at wave lengths of 2,537Å (very near to the maximum bacterial activity of ultra-violet light) has made available an easy and relatively cheap method for aerial disinfection. However, the optimum conditions for the effective use of ultra-violet light need to be more clearly defined. Bacteria have been found to be more sensitive in dry than in humid atmospheres, but this may be partly due to different methods of air sampling. No reliable data are available to indicate what is adequate irradiation for disinfection of the atmosphere. Most tests are carried out in a clean experimental chamber with moist or dry bacteria finely sprayed into the air and the results thus indicate only the minimum irradiation required under ideal conditions. The presence of gross particles, such as dust, interferes materially with the effectiveness of ultra-violet light. The apparatus used also varies. Some use an irradiated ceiling, others use screens of ultra-violet light to act as barriers between beds, and others use ultra-violet light in air ducts. The extension of ultra-violet light to schools at Philadelphia apparently reduced the incidence of measles and chickenpox among the children in the irradiated classrooms. Good results in preventing cross-infection in children's hospitals, particularly respiratory infection, have been reported, and ultra-violet light has also been used in surgical theatres to prevent airborne infection of the wound during prolonged operations. Precautions must be taken to protect staff against over-exposure. C.

**Atmospheric Humidity: Physiological Influence.** American Society of Heating and Ventilating Engineers. *Inst. Heat. Vent. Eng. J.*, 1942, 9, 369-376 (through *Building Sci. Abstr.*, 1943, 16, 141-142). The present state of information about the physiological aspects of air conditioning is reviewed with respect to the following problems involved:—(a) *Influence of atmospheric humidity in cool air upon heat losses from the human body.* Experimental evidence is adduced to show that there is no physiological basis for humidifying air at moderate or low temperatures on thermal grounds. Evaporative heat loss is small and the vapour pressure difference of a cool atmosphere under moist and dry conditions is relatively small compared with the vapour pressure at the surface of the hot skin. An increase of 20-25 per cent. R.H. is required to compensate for a 1° F. decrease in air temperature. (b) *Influence of atmospheric humidity in warm air upon heat losses from the human body.* In the zone of evaporative regulation (above 60° F. for a clothed subject doing active work in still air or above 85° F. for the unclothed subject at rest) relative humidity and evaporative cooling become vitally important factors in comfort conditions, being influenced by metabolic activity, clothing and rate of air movement. As atmospheric and radiational temperatures rise above the critical point, evaporative cooling and heat dissipation are mutually compensated by a well-balanced increase in sweat secretion. The upper limits

of evaporative heat regulation are set, in very hot and dry air, by cessation of sweat secretion, and in very moist air by failure of sweat to evaporate from the body surface; these limits are shown graphically for various temperatures, humidities and working conditions and their significance is discussed. (c) *Influence of atmospheric humidity upon the dryness of the membranes of the nose and throat.* The researches of Seeley have shown that the drying effect on the mucous membrane is related to the absolute humidity of the atmosphere. Further studies by Winslow, Hemington and Nelsbach have established that, in this process, there is a critical point at 0.4 in. atmospheric vapour pressure below which, at any temperature from 50°-80° F., the throat surface is very definitely dry. To control the influence of dry air on the mucous membranes would necessitate a relatively high vapour pressure corresponding at 70° F. to over 50 per cent. saturation. C.

**Hot Dry Atmospheres: Physiological Effects.** F. C. Houghten, C. Gutherlet and M. Ferderber. *Heating, Piping*, 1943, 15, 205-208 (through *Building Sci. Abstr.*, 1943, 16, 175). Observations were made over the effective temperature range 77.5° to 95° F. with relative humidities of 30 per cent. and less. The results are recorded graphically and discussed. For a given effective temperature, the increase in pulse rate and in body temperature of workers at R.H. 30 per cent. and lower show the same reaction as previously found for higher relative humidities. Body temperature rise at 30 per cent. R.H. correlated well with effective temperature, showing a consistent rise after 3 hours' exposure to effective temperatures above 85° F. with a measurable rise for conditions above 90° F.. It was also found that about 3° rise in the mean radiant temperature had about the same effect as 1° rise in the effective temperature. The present data also conclusively confirmed the earlier findings that a person is comfortable at a slightly higher effective temperature when standing and moving about at work than when seated at rest. C.

#### (H)—WATER PURIFICATION

**Sodium Hexametaphosphate: Stability.** M. Kehren. *Zellwolle, Kunstseide, Seide*, 1943, 48, 133-134 (through *Chem. Zentr.*, 1943, ii, 386 and *Chem. Abstr.*, 1944, 38, 1593<sup>4</sup>). Recent tests show that sodium hexametaphosphate is hydrolysed only slowly at temperatures up to 100° and in the region of greatest stability, neutral up to faintly alkaline; hence for textile technical purposes 70° should no longer be considered the limiting temperature. C.

#### PATENT

**Yarn Beam Transport Apparatus.** Atlantic States Motor Lines, Inc. U.S.P. 2,335,516/7/8. These inventions relate to modifications of a framework for mounting heavy beams of yarn (rayon tyre cord or warps) on two tiers on a lorry or truck. The flanges of the beams run on tracks and the framework includes means for scotching the beams and locking them together. C.

### 9—PURE SCIENCE

**Colloidal Solutions: Coagulation; Formation of Chain Aggregations.** K. Hoffmann. *Kolloid Z.*, 1943, 103, 161-163 (through *Chem. Abstr.*, 1944, 38, 1160<sup>9</sup>). Equations are derived to show that the chains formed during the coagulation of colloidal solutions are due primarily to electrostatic forces which disappear faster at the chain fronts than on the sides of the chains, so that additional particles will attach themselves to the front. A secondary force is the induced dipole moment which causes greater attraction at the front surfaces. C.

**Molecular Dispersions; Kinetics of Aggregations in —.** H. Umstätter. *Kolloid Z.*, 1943, 103, 150-159 (through *Chem. Abstr.*, 1944, 38, 1161<sup>5</sup>). The molecular weight determinations of polymers if based on viscosity measurements may give too high or too low values. This may be due to the presence of freely rotating atom groups on the molecules which in a liquid medium behave as if they were dissociated although bound chemically by valence forces. On the other hand there are molecules that form aggregations in a liquid phase even though not connected by valence forces. The study of these cases is the purpose of the kinetics of aggregations. Examples are given of aggregations found in binary mixtures of water with one of the following: methyl, ethyl, propyl or

allyl alcohol, nitric, sulphuric or acetic acid. Viscosity curves are given at various concentrations and temperatures. The viscosities are due in most cases not to the molecules but to the aggregations formed. The composition of these micelles varies with the temperature. In water and methyl alcohol the micelle consists at 0° of  $1\text{CH}_3\text{OH}$  and  $4\text{H}_2\text{O}$ , whilst at 30° it consists of  $1\text{CH}_3\text{OH}$  and  $3\text{H}_2\text{O}$ . C.

**Starches: Water Sorption.** L. Sair and W. R. Fetzer. *Ind. Eng. Chem.*, 1944, 36, 205-208. Sorption isotherms have been obtained for seven varieties of starch on samples subjected to intensive desiccation and also on unheated controls. From these data the starches can be divided into cereal, pith or root, and tuber groups. If the hydroxyl group is the point of attachment for water, the results indicate that potato or tuber starch has a higher percentage of free hydroxyl groups available for the attachment of water molecules than has either pith or root starch or cereal starch, that is, the degree of association of the starch types follows the order: cereal > root or pith > tuber. This association difference may be connected with the differences in the gelation properties of these starches. Differences in the extent of hysteresis were observed. Desiccation reduced the ability of the starches to retain water, the greatest effect being on tuber starches at high temperatures. The sorptive capacity of potato starch was reduced to a value similar to those found for cereal starches, without causing gelatinisation or injury of the granule, by treating the air-dried potato starch for 3 hours with steam at a pressure of 5 lb. per sq. in. This treatment produced changes in the X-ray pattern and the pasting characteristics of the potato starch. C.

**Industrial Viscometers.** Ruth N. Weltmann. *Interchemical Review*, 1943, 2, 43-52. The various types of viscometers are reviewed and their suitability for use with plastic and thixotropic materials is indicated. The advantages of rotational viscometers are pointed out and the manner in which the material is sheared in a rotational viscometer is explained. Plug flow, the end effect, and mechanical problems influencing the design of rotational viscometers are studied. The "Interchemical" rotational viscometer is described. The most important equations relating to the use of rotational viscometers are summarised. C.

**Cellulose Acetate: Viscosity and Molecular Weight.** S. Bezzi and U. Croatta. *Atti ist. Veneto sci.*, 1939-40, 99, 905-931 (through *Chem. Zentr.*, 1941, ii, 887-888 and *Chem. Abstr.*, 1944, 38, 1356). The different behaviours of cellulose triacetates prepared by the method of exhaustive acetylation have been ascribed by various authors to the difference in the size of the micelles or of the molecule (different degrees of acetolysis). The preparation and fractionation of cellulose triacetate and of cellobiose acetate are described. The viscosities and molecular weights were determined by different methods. It is concluded that the solutions studied in this work represent molecular and not micellar dispersions and that the differences are a result of differences in the degree of polymerisation (D.P.). There is no clearly defined relation between D.P. and solubility because the latter also depends upon other factors. The cryoscopic method cannot be used for the molecular weight determination of these acetates. The value of  $\eta_{sp}/c$  for each fraction increased with concentration, the more so the higher the initial value of  $\eta_{sp}/c$ , a behaviour which appears to be characteristic of thread-like polymers in molecular dispersion and seems to indicate that the dispersions of the products investigated are of this type. A characteristic for each substance was the value of  $\eta_{sp}/c$  extrapolated for  $c \rightarrow 0$ . The viscosity increased with increasing temperature of acetylation or, at the same temperature, with the time of reaction. The temperature coefficient of viscosity is not large, from which it follows that the high viscosity is to be ascribed to the size of the dispersed particles and not to their solvation. The differences in the viscosity of the different fractions are not large ( $\eta_{sp}/c$  for  $c \rightarrow 0$  varies from 6 to 10.5). That the solutions contain molecules and not micelles follows from the fact that the individual fractions always have the same viscosity, even in various solvents or after different treatments (e.g. after repeated precipitation from acetic acid with water, by which a part of the compound becomes insoluble in cold acetic acid. The molecular weight was determined by the osmometric method and by determination of the acetyl content.

The acetyl content was somewhat higher than that calculated for cellulose triacetate (44.8 per cent.), which is explained on the assumption that in the end groups of the chain molecules, four instead of three hydroxyl groups are acetylated. The molecular weight by the cryoscopic method is too low because of supercooling and of the delay in the separation of the solid phase. C.

**Polymer Solutions: Rigidities.** J. D. Ferry. *Ann. N.Y. Acad. Sci.*, 1943, 44, 313-327 (through *Sci. Abstr.*, 1944, 47 A, 39). Solutions of a linear polymer of high molecular weight in a solvent with which it is miscible in all proportions grade uniformly from viscous liquids through gelatinous or rubber-like consistencies to plastic solids. The theory of the mechanical properties of such solutions is discussed in terms of the simplest mechanical model, the Maxwell element. Several methods of determining the rigidities of solutions of polymers are described. The results of measurements of the rigidities of solutions of polybutene, polystyrene, polyvinyl chloride, and polymethyl methacrylate are reviewed. The mechanical properties are discussed in terms of polystyrene in xylene. A mechanical model is proposed which describes all the properties of the polystyrene-xylene system, and consists of elements which can be identified with molecular processes. C.

**Polystyrene: Thermoplastic Flow.** N. M. Foote. *Ind. Eng. Chem.*, 1944, 36, 244-248. Measurements were made, over a wide range of temperatures and under different applied stresses, of the rate of compression of disks of polystyrene in a parallel plate plastometer and of the length of flow into capillary tubes. Nomographs were devised for calculating the apparent viscosity from the observed data. The empirical equation giving apparent viscosities of polystyrene for low stresses as a function of absolute temperature is  $\ln \eta = (40,000/RT) - 30$ . At higher stresses much lower apparent viscosities were observed. Possible explanations of this behaviour are briefly discussed. C.

**Plastic Materials: Thermal Expansion.** R. F. Clash, Jr., and L. M. Rynkiewicz. *Ind. Eng. Chem.*, 1944, 36, 279-282. A simple dilatometer technique for determining the volume/temperature relations of plastics is described, and data are reported for a number of thermoplastic materials, including vinyl chloride-acetate, polyvinyl butyral and methacrylate resins and cellulose esters. Calculated cubical expansion coefficients below and above the observed transition temperatures are reported, and the effect of plasticizer addition on the expansion coefficients and transition temperatures is discussed. In general plasticizers cause a lowering of transition temperature and it is suggested that this lowering may be analogous to the lowering of the freezing point observed with solutions. Polyethylene shows expansion characteristics similar to those of paraffin wax and appreciably different from those observed for the other thermoplastics studied. C.

**Rubber Molecules: Statistical Strength.** L. R. G. Treloar. *Trans. Faraday Soc.*, 1944, 40, 109-116. The methods worked out for the determination of the statistical lengths of paraffin chains are applied to the more complex problem of the rubber molecule. Distribution functions covering lengths up to 98 per cent. of the fully extended length are given for chains corresponding to molecular weights up to 17,400. C.

**Silkworm and Moth: Radioactivity and Uranium Content.** J. Hoffmann. *Z. physiol. Chem.*, 1942, 276, 275-279 (through *Chem. Abstr.*, 1943, 37, 5496<sup>1</sup>). The dry mass of the moth consists chiefly of calcium phosphate. The body of the pupa, without the chitinous shell, contains  $2.4 \times 10^{-7}$  g. of U per gm., the chitin shell  $6.78 \times 10^{-6}$  g. and the silk shell  $7.84 \times 10^{-6}$  g. The highest concentration of uranium is in the pupa (insect and chitin). The developing insect body is exposed to the  $\alpha$ -,  $\beta$ - and  $\gamma$ -rays of uranium and the weaker  $\beta$ -rays of  $K^{41}$ . A high concentration of U in the silk gland is presumed. The silk shell of the cocoon, impermeable to water, must ionize the air between the silk and chitin shells. The resting pupa is subject to the radioactivity of the accumulating uranium. C.

**Alumina Fibre: Use as Chromatoscopic Adsorbent.** H. Wislicenus. *Kolloid Z.*, 1942, 100, 66-82 (through *Sci. Abstr.*, 1944, 47A, 61). A comparison is made between organic fibres and the inorganic alumina fibre. Natural fibres are too brittle, too bulky and not sufficiently elastic for use as adsorbent; specially

prepared fibres are required. The activation of the aluminium by mercury halides is similar for both kinds. The process of preparation of the fibres, their uses in adsorption measurements, and automatic adsorption apparatus, are described and illustrated. C.

**Solvent-resistant Fritted Resin Filters: Production.** H. Rudolph. *Kolloid Z.*, 1943, 103, 164-166 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1944, A:816). The method commonly used in manufacturing ceramic filters, i.e., softening the surface of granulated material by heat and pressing under conditions which produce porous structure, may be applied to thermoplastic materials, but the products have a limited resistance to heat. In the manufacture of Iganil (aniline-formaldehyde) and Luvikan (polyvinylcarbazole) filters the softening by heat is replaced by swelling in organic solvents. With suitable solvents, filters are obtained which are solvent-resistant and heat-resistant up to 180° C. A fibrous superpolyamide filter can be manufactured by dissolving the polymer, precipitating it by a non-solvent, and pressing the precipitate without application of heat. The material can also be dispersed after autoclave treatment in the presence of water and the dispersed material pressed under the application of heat. The superpolyamide filter thus obtained shows a very limited resistance to water. The material can, however, be rendered water-resistant by admixing paraphenylenediamine (Demosit). Superpolyamide filters are temperature-resistant up to 140-150° C. The fritting temperature (120-190° C.) of resin filters is lower than that required for ceramic filters (700-1200° C.) and it is not necessary to shape the resin material before fritting. Resin filters are characterised by high uniformity of pore size and distribution. C.

**Lead: Detection in Water and Fine Chemicals.** F. Feigl and N. Braile. *Analyst*, 1944, 69, 147-149. For the determination of traces of lead in water, sodium mercuric sulphide and ammonium chloride are added. The precipitate of mercuric sulphide which is formed acts as a collector for minute quantities of lead sulphide and is filtered off on a porcelain Gooch crucible, moistened with hydrogen peroxide, dried and gently ignited. Lead sulphate may be identified by the formation of red rhodizonate of lead on spotting with sodium rhodizonate and buffer solution. Details of the reagents and procedure are given. Under the specified conditions lead may be detected in 10 ml. of water at a dilution of 1 in 10 millions, or in 100 ml. at a dilution of 1 in 100 millions. The test takes about 20 min. Traces of lead in certain fine chemicals can be detected by dissolving samples in water and testing as for water. C.

**Ozone: Occurrence and Determination.** J. L. Edgar. *Discovery*, 1944, 5, 104-107, 114, 141-143, 155. A popular account of the discovery, occurrence and properties of ozone is followed by a discussion of methods for the measurement of the extremely minute quantities of ozone in the atmosphere, with special reference to the Dobson ozone spectrometer (1931), and the separation of ozone from nitrogen dioxide by condensation and distillation. The following figures are recorded for these gases in the atmosphere: London, O<sub>3</sub> 1.3, NO<sub>2</sub> 0.3; Kew O<sub>3</sub> 2.4, NO<sub>2</sub> 0.75; Southport, O<sub>3</sub> 2.3, parts per 100 million. C.

**Dimethylaniline: Determination in Mixtures with Aniline and Methylaniline.** J. Haslam. *Analyst*, 1944, 69, 141-145. A method for the rapid colorimetric determination of dimethylaniline (up to 20 per cent.) in mixtures with aniline and methylaniline involves acetylation, dissolution in water, and reaction with nitrous acid. The absorption of the solution of the yellow nitroso body produced is measured in a Spekker absorptiometer. For the determination of larger quantities, i.e., of the order of 60 per cent. of dimethylaniline, use may be made of the method of Blumrich and Bandel for the titration of weak organic bases with perchloric acid in glacial acetic acid solution. The mixture is first treated with acetic anhydride to acetylate the primary and secondary bases, then the acetylation product is dissolved in glacial acetic acid, and the dimethylaniline is titrated with perchloric acid in glacial acetic acid solution,  $\alpha$ -naphthol benzein being used as indicator. C.

**Cellulose: Nitration in Organic Solvents.** J. Desmaroux, R. Dalmon and Genevieve Petitpas. *C. r. Acad. Sci.*, 1941, 212, 396-398 (through *Chem. Zentr.*, 1941, ii, 1104-1105 and *Chem. Abstr.*, 1944, 38, 1637<sup>2</sup>). The nitrogen content resulting on nitrating cellulose in mixtures of anhydrous nitric acid with ether,



dichlorodiethyl ether, acetic acid, propyl alcohol, butyl alcohol, acetic anhydride, chloroform and phosphoric acid depends on the mixed acid ratio. The mixture with ether does not nitrate and is unstable. The mixtures with chlorine compounds and fatty acids yield nitration products, if the nitric acid content is in equimolecular proportion or greater, whereas the acetic anhydride ratio must be 1:3. Mixtures containing chloroform or phosphoric acid require only a low content of nitric acid. The conclusion is drawn that the nitrating ability of the nitric acid is influenced by the basicity of the added substance, and that the condition of the nitric acid molecule in the mixtures, should be investigated by physical methods (Raman effect, infra-red spectrum, etc.). C.

**Methylated Starch: Fission Products.** K. Hess, H. A. Schulze and B. Krajnc. *Ber. deut. chem. Ges.*, 1940, 73, [B] 1069-1076 (through *Brit. Chem. Physiol. Abstr.*, 1944, A II, 93). When methylated potato starch (40-41 per cent. methoxyl) is treated with sodium, liquid ammonia, and methyl iodide in anisole, the product contains usually about 44-45.5 per cent. of methoxyl; high methoxyl content is obtained only if not too much sodium is used, an excess causing back-hydrolysis. Methyl iodide-silver oxide similarly gives variable results up to 45.6 per cent. of methoxyl. Hydrolysis of a product containing 45.55 per cent. of methoxyl gives methyl-tetra- 3.99, -tri- 86.7, -di- 4.77, and -mono-methylglucoside 2.27 per cent. The conclusion is drawn that methylation is still incomplete but may involve structural changes. C.

**Diazo-Coupling Reaction: Mechanism.** H. H. Hodgson and E. Marsden. *J. Soc. Dyers & Col.*, 1944, 60, 120-124. The general mechanism of diazo-coupling put forward in a previous paper is shown to interpret (1) the coupling of phenols and naphthols, including the special cases of salicylic acid, 4-nitro-2-naphthol, resorcinol, and 1:5-dihydroxynaphthalene; (2) mobility of the azo-hydrazone equilibrium as altered by solvents, e.g. pyridine and nitrobenzene; (3) the coupling of amino compounds, including aniline and the transformation of diazoaminobenzene into aminoazobenzene; (4) the decoupling of H-acid and the exclusive monocoupling of  $\gamma$ -acid and J-acid; (5) the effect of pyridine on the coupling reaction; (6) the diazo-exchange reaction; and (7) the coupling of phenol ethers. A re-interpretation of ideas held 20 years ago, e.g. the oxonium and ammonium theories of coupling, is given on the basis of modern electronic and resonance theory. C.

**Fat Antioxidants: Application.** C. H. Lea. *J. Soc. Chem. Ind.*, 1944, 63, 107-112. Of a number of antioxidants tested in butter fat at 100° and 37° C. pyrogallol, quinol, 1:5-dihydroxynaphthalene, pyrogallol-acetone condensation product, gallic acid and its esters, pyrocatechol, and hæmatoxylin proved most powerful. Proline, protocatechuic acid, tannic acid, guaiacum resin, a concentrate of natural mixed tocopherols, 6-hydroxy-2:2:5:7:8-pentamethyl-chroman, and several other substances showed definite, but weaker activity. There was usually fairly good agreement between the relative potencies of inhibitors as observed at the two temperatures, though the degree of protection afforded by a given concentration of a particular substance appeared to be greater at 37° than at 100°. The lower esters of gallic acid proved most satisfactory in affording marked protection against oxidation without causing discoloration or imparting foreign flavour. In butter fat exposed to air at 37°, 0.005 per cent. of ethyl gallate considerably retarded the development of tallowness and loss of carotene. In lard under similar conditions, 0.01 per cent. of ethyl gallate was very effective in delaying the onset of tallowness, whilst the same proportion of this inhibitor in refined and deodorised cottonseed, arachis, and palm oils at 25° had some effect in retarding oxidation as measured by the peroxide value and, in less degree, deterioration in flavour as indicated by a tasting panel. C.

**Melamine-Formaldehyde Condensation Products.** R. Köhler. *Kolloid Z.*, 1943, 103, 138-144 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 112). The reactions between melamine and formaldehyde with formation of plastics are discussed. The polymerisation of the primary product may occur by formation of oxygen bridges or NH.CH.NH bridges, and both reactions may take place together. Products only slightly soluble in water dissolve almost completely in pyridine. On heating, the solubility in pyridine decreases, at first slowly and then more rapidly. The unhardened resin has molecular weight 800-1,000.



On heating for some time at  $100^{\circ}$ , the molecular weight of the fraction soluble in pyridine increases to more than 3,000. A small quantity of formaldehyde is evolved on heating to  $100\text{--}150^{\circ}$ . C.

**Fibres: Genesis.** W. Ostwald. *Kolloid Z.*, 1943, 102, 35-60 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 84); also Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1944, C:300. The general conditions determining the formation of fibres of all types, natural and artificial, are discussed. A fibre can originate by translatory motion of a nuclear disc (solid fibre) or ring (hollow fibre), and can grow either basally or apically. It may result from any of the processes of condensation, deformation, dissolution, or partial dispersion. Five fundamental questions regarding the physico-chemical conditions necessary for fibre growth are considered in detail, viz., (1) processes providing material for the growing fibre, (2) transport mechanism making the material available at the right point, (3) energy-providing processes, (4) factors determining direction of growth, (5) formative mechanism controlling shape and size of fibres. The phenomena of growth of silver fibres on heated silver sulphide and of copper fibres on cuprous sulphide are described in detail, and theories advanced which comply with the five conditions for growth. The silver ions in heated silver sulphide are mobile and exert an ionic pressure on a particle of silver in contact with the silver sulphide. This leads to deposition of silver atoms, electronic equilibrium being maintained by volatilisation of sulphur derived from sulphur ions in the lattice. Many details of the phenomenon are in accordance with the theory. The electrochemical processes are different in copper fibre formation. C.

**Soaps: Transitions between Homogeneous and Heterogeneous Systems.** J. Stauff. *Z. Electrochemie*, 1941, 47, 820 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 85). If the state of aggregation is determined as a function of total concentration by means of the law of mass action, it is possible to distinguish between homogeneous and heterogeneous equilibria in colloid systems. The equilibrium between colloidal aggregates and single molecules in soaps has been investigated by means of colour indicators, the change being determined spectrophotometrically. When the aliphatic chain has 8, 10 or 12 carbon atoms the equilibrium is homogeneous. C.

**Chain Molecules: Kinetics of Depolymerization Reactions.** A. Matthes. *J. prakt. Chem.*, 1943, 162, 258-278 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1944, 334). If a chain molecule of degree of polymerisation  $P$  is split into  $(n+1)$  molecules of degree of polymerization  $P_0$ ,  $P$  is given by  $P = P_0/(n+1)$ , and  $n$ , the number of breaks, is given by  $n = (P_0/P) - 1$ . The number of breaks per base molecule is given by  $n/P_0 = (1/P) - (1/P_0)$ . The expression  $S = 1/P$  is termed the "degree of degradation." The increase in degree of degradation,  $(1/P - 1/P_0)$ , is independent of the course of the depolymerization reaction, e.g., it is not affected by acceleration or slowing down of this reaction. The expression  $(1/P - 1/P_0)$  can be used for comparing degree of polymerization intervals. C.

**Macromolecular Substances: Thermal Behaviour.** K. Ueberreiter. *Kolloid Z.*, 1943, 102, 272-291 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 56 and Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1944, 116, 116.2 and 150). The properties of a substance in any state of aggregation are determined by the freedom of motion of its molecules. In liquids the thermal energy of molecules is sufficient to overcome the potential barriers surrounding them. In crystalline solids the potential barriers are all of similar magnitude; in amorphous bodies they differ, hence the melting process is not sharp, and a place-exchange occurs below the melting point, resulting in increased orientation. The freezing point of amorphous bodies is determined experimentally as the point of intersection of specific volume-temperature curves for solid and liquid. In a macromolecular liquid the chain members are more strongly influenced by their neighbours in the same chain than by those in other chains. The relative magnitudes of inter- and intra-molecular forces determine whether chains move as a whole or whether chain units move relatively to one another. The relation of chain length to freezing point shows that large molecules must be sub-divided into small kinetic units having varying degrees of thermal agitation. The state in which the kinetic energy is distributed among chain members, but not whole

molecules is described as a liquid with fixed structure. Its range of existence is greater the greater is the chain length. Macromolecular substances are classified according to their thermal properties into (i) rubber-like polymers, with weak intramolecular forces and wide temperature range of liquid with fixed structure, (ii) thermoplastics, with smaller and higher temperature range of liquid with fixed structure, and (iii) non-softening polymers, with small or no range of liquid with fixed structure. Intramolecular movement is limited by electrostatic forces, and modification of physical properties necessitates modification of electric moments, especially of side-groups or chains, e.g. chlorination of polyvinyl chloride or replacement of chlorine by ester groups lowers the freezing point by compensation or reduction of dipole moments. Internal mobility may be increased or decreased by netting of chains, according to its effect on the dipoles. External plasticisers reduce intramolecular forces and so increase the mobility of chain members. C.

**Cellulose Nitrate Solution: Viscosity Fall on Ageing; Effect of Inorganic Salts.** J. S. Gourlay. *J. Soc. Chem. Ind.*, 1944, **63**, 123-124. Solutions of sodium and calcium chlorides were shaken in the ratio of 5 vols. of aqueous solution to 95 vols. of freshly distilled acetone and allowed to settle. The supernatant liquid was then used as the solvent to make a solution of cellulose nitrate containing 20 g. of the solute per 100 ml. of the solvent. A mixture of distilled water and acetone was made up at the same time into a 20 g. per 100 ml. solution of cellulose nitrate (the "blank"). The solids contents of the three solvents were found to be: sodium chloride in solvent 0.021 g. per 100 ml.; calcium chloride in solvent 0.039 g. per 100 ml.; blank solvent 0. The solutions were aged in the dark and viscosities determined by the falling-sphere method at 25°. The results show that the presence of the salts caused a decrease in the initial viscosity of the solution and increased the rate of decrease of viscosity on ageing. It has been observed that the viscosity of solutions of cellulose nitrate made with acetone dried over calcium chloride is lower and falls more rapidly than that of corresponding solutions made with freshly-distilled acetone. C.

**Colloidal Solutions: "Viscosation."** H. Fromm. *Kolloid Z.*, 1943, **102**, 86-90 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 84). The term "viscosation" is used to describe the increase of viscosity with concentration. Methods of expressing concentration are examined in relation to the change in size of solute particles arising from solvation. New terms and symbols are proposed for the principal magnitudes in viscosity/concentration relationships. C.

**Linear Molecules: Determination of Molecular Weights and Dimensions.** H. Umstätter. *Kolloid Z.*, 1943, **102**, 232-245 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1944, 215 and 215.2). The tensile strength of a liquid is assumed to be equal to the sum of the tensile strengths of its structural lamellae. Since the lamellae are assumed to be bimolecular, the following expression is obtained:  $r = 2\omega/E$ , where  $r$  = linear dimension of the molecule,  $\omega$  = surface tension, and  $E$  = shearing elasticity. For a number of compounds,  $E$  has been determined from the viscosity/temperature curve, and  $r$  calculated according to the given formula. Linear dimensions of the molecules can be obtained with an accuracy of  $\pm 0.75$  Å. Most high polymers are solids, and their surface tension is not known. Melting is usually accompanied by degradation so that a determination of the surface tension is not possible. In most cases, where no degradation occurs, the viscosities of the undiluted substances are so high that a determination of the shearing elasticity on the basis of viscosity/temperature curves is impossible. It has previously been shown that the molecular weight averages of solution and solvent are proportional to the squares of the absolute critical temperatures of viscosity/temperature curves of equal slope. The accuracy of the method decreases with increasing difference between the molecular weights of solvent and solute. Satisfactory results have been obtained with lubricating oils (molecular weight 300-400) dissolved in decane fractions (molecular weight about 140). Attempts to apply the method to solutions of aluminium stearate in iso-octane (molecular weights about 900 and 104, respectively) and to higher molecular lubricating oils in benzene (molecular weights above 600 and 78, respectively) were unsuccessful. In these cases, the viscosity/temperature curves of the solution are so flat that

a realisation of equal slope is impossible. The method is not applicable to high polymers. C.

**Mucin: Structure-viscosity.** P. Zamboni. *Kolloid Z.*, 1943, 102, 246-251 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 62). A viscometer is described which enables the time of outflow to be measured at various pressures and is especially suitable for the investigation of "fibrocolloids." Structure viscosity is especially marked in solutions of mucin, but is not observed in the presence of salts in sufficient concentration. The salt concentrations necessary are of the same order as those required for the activation of enzymes that dissolve mucin. C.

**Organic Compounds: Viscosity and Hydrogen Bond Formation.** C. E. Kendall. *Chemistry and Industry*, 1944, 211. The viscosity of a liquid will depend on molecular shape and size, and on the strength of the forces between the molecules. Co-valent compounds may be roughly divided into three groups according to the intermolecular attractions present:—(a) van der Waals forces only (these increase in strength with the size of the molecules), (b) dipole attractions plus van der Waals forces, (c) hydrogen bonds plus dipole forces plus van der Waals forces. To show the influence of these forces, a diagram showing viscosity (on a logarithmic scale) against molecular weight is given. Except for the first few members each homologous series gives a straight line. The paraffins occupy the lowest portion, whilst compounds which have strong hydrogen bonds are near the top; the intermediate positions are filled by compounds which have weak hydrogen bonds or dipole forces. A comparison of groups of compounds of similar molecular weight and configuration illustrates the effect of the forces concerned. The aliphatic acids have lower viscosities than the corresponding alcohols. This can be attributed to the fact that the alcohols form transient groups of molecules linked by hydrogen bonds, whilst the acids tend to form dimers in which the hydrogen bonds are stabilized by resonance; the viscosity of an acid is roughly the same as that of a polar compound (e.g. an ester) of double the molecular weight. The viscosities of the chlorophenols suggest that hydrogen bonding occurs—mainly intramolecular in the *o*-compound (4.20 cp.), and intermolecular in the others, *m*-, 16.70 cp., and *p*-, 23.0 cp.). C.

**Ultra-violet Fluorescence Analysis Lamps.** J. A. Radley. *J. Soc. Dyers & Col.*, 1944, 60, 114-119. Sources of ultra-violet light are discussed and various high-temperature discharge lamps suitable for use for fluorescence analysis in textile laboratories are described. Suitable filters for removing visible light are discussed. C.

**Dyes: Polarisation of Fluorescence and Anisotropy.** P. P. Feofilov. *J. Physics U.S.S.R.*, 1943, 7, 68-79 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 77). Curves showing the dependence of polarisation of fluorescent light on the wave length of the exciting light (polarisation spectra) have been obtained for rhodamine-B, Na fluorescein, Na eosin, tryptaflavine, acridine-orange, benzoflavin, Na perylenetetracarboxylate, aesculin, and pinakryptol-yellow. These polarisation spectra are specific for each dye. For Na eosin, tryptaflavine, acridine-orange and benzoflavin, the variation of dichroism of oriented molecules with wave length is investigated, and there is a correspondence between this and the polarisation spectrum. This indicates that the angles between emitting and absorbing oscillators are not produced during the excitation, but are inherent in the molecule. The anisotropy of the molecules can be interpreted by means of an oscillator model in which the fluorescing molecule is regarded as an emitting oscillator with a number of absorbing oscillators rigidly coupled to it. C.

**Fluorescent Pigments: Determination of Concentration from Fluorescence Intensity.** P. Ellinger and M. Holden. *J. Soc. Chem. Ind.*, 1944, 63, 115-121. The various methods used in fluorimetry are briefly discussed and photo-electric methods and apparatus are described. The superiority of an electrical balancing method, at least for routine work, is demonstrated. The dependence of the fluorescence intensity on the absorption of the primary light, the depth of the fluorescent layer, and the concentration of the fluorescent substance is discussed and absorption and fluorescence curves are given for a number of

pigments in various solvents. Over a wide concentration range a linear proportionality is observed between the logarithm of the fluorescence intensity and the logarithm of the concentration when narrow containers are used. The relative merits of fluorimetry and absorptiometry are discussed.

**C. Dichromat Eyes: Colour Mixture and Chroma Discrimination; Quantitative Formulation.** G. A. Fry. *J. Optical Soc. America*, 1944, 34, 159-166. Colour mixture data for dichromats are characterized by the fact that the various spectral stimuli can be matched by mixtures of two properly chosen primaries. The following equation is given for the percentage  $P$  of blue in the mixture of red and blue primaries required to match the various spectral colours of wave length  $\lambda$ :  $P = 100 / \{ 1 + 10^{K(\lambda - \lambda_0)} \}$ . The intensities of the two primaries can be expressed in terms of either energy or brightness; changing from one to the other merely changes the value of the constant  $C$ . The constant  $K$  remains relatively constant from one dichromat to another. When the intensities of the two primaries are expressed in brightness units,  $C$  is also relatively constant. The use of the formula in determining the spectral match for a heterochromatic stimulus of known wave-length composition is described. This procedure is used for calculating the spectral match for white from the colour mixture and visibility data. The calculated values are compared with the match determined by direct comparison by a protanope and a deuteranope. The procedure is also employed in testing whether colours of different wave length composition that appear alike to trichromats also appear alike to dichromats. A short method of determining the value of  $C$  for a given dichromat is described. The transformation of chroma discrimination data for dichromats from a wave-length scale to a colour-mixture scale is studied.

C.

**Ishihara Colour Blindness Test: Criticism.** R. W. Pickford. *Nature*, 1944, 153, 656-657. The Ishihara Test (8th edition, 1939) was given to 87 subjects tested with the Rayleigh equation, including 14 red-green blind men, 4 red-green blind women, 2 green anomalous men, 13 red-green weak men, 18 red-green weak women, 9 normal men and 27 normal women. No colour blind or anomalous subject gave more than one reading unequivocally correct in 24 plates. Four protanopes were not distinguished from deuteranopes by the test, nor two deuteranopes from protanopes. Moderately colour blind were not consistently distinguished from extreme, nor anomalous from colour blind. On a level of failure of 19 or less correct in 24 plates, the Ishihara Test would have failed 9 of the 31 red-green weak subjects, but not consistently the weakest, and 9 of the 36 normals. Proportions of correct, alternative and "blank" readings gave no accurate information about degree of weakness, though the test was used in a very strict manner. The conclusion is drawn that the Ishihara Test is unsatisfactory as a scientific instrument. It also errs on the side of severity (a good fault) but in an indiscriminating way.

C.

**Omega Colour Space.** J. L. Saunderson and B. I. Milner. *J. Optical Soc. America*, 1944, 34, 167-173. A further study is made of the  $\omega$ -space proposed by Moon and Spencer. Additional Munsell data are transformed to the  $\omega$ -space in order to determine with what accuracy the Munsell colour space is described by the theory. In order to facilitate the comparison of results, a standard adaptation is chosen. The  $\omega_2$  function is altered slightly to improve the agreement with the recommended data at low values. The relation between hue angle  $\theta$  and dominant wave length is investigated. Additional Munsell data are plotted in the  $\omega_1\omega_2$  planes, and a plot in the  $\omega_1\omega_3$  plane is extended to the higher chromas. Differences between the theory and the Munsell data are discussed. The  $\omega$ -space does not appear to be a sufficiently accurate mathematical description of the Munsell colour space to deserve wholehearted acceptance by colorists in industry.

C.

**Short Wave Fundamental Colour: Experimental Determination.** G. F. Göthlin. *J. Optical Soc. America*, 1944, 34, 147-158. Arguments hitherto advanced for violet and blue, respectively, as a fundamental colour in man's colour sense are reviewed and an account is given of experimental work designed to solve this problem. By means of the author's liminospectroscope, colour-threshold analyses in spectral indigo were made with five subjects of normal colour vision. With three out of the five, throughout the whole or nearly the whole of the indigo region, when the radiant flux was increased from zero, a

colour-threshold for blue was reached at a lower flux, whilst only at a higher flux did a red component begin to be discernible and add itself to the already present blue to form the special type of violet that Newton called indigo. One of the remaining subjects observed the separation into a threshold for blue and a threshold for red for a few wave lengths only and the other observed no separation. These results appear to justify the conclusion that blue has its own receptors and is the short-wave fundamental colour, whilst violet is not a fundamental colour with special receptors. This conclusion is supported by the fact that in the purest cases of congenital tritanopia the radiations of spectral violet release a sensation of colour in which only red is perceived. C.

**Microphotography Apparatus: Application.** G. W. W. Stevens. *Photographic J.*, 1944, 84, 108-111. The choice of a suitable sensitive material for the production of microphotographs, and the construction, adjustment and operation of the apparatus are discussed. Various methods of bringing a minute image to a sharp focus at the emulsion surface are critically examined. Series of exposures forming a focusing test often reveal a sharp image situated in the lower layers of the emulsion; this phenomenon is explained by considering the properties of the aerial image and of the emulsion used. C.

**Plastic Materials: Stress-Strain-Time Problems.** G. W. Scott Blair. *J. Sci. Instruments*, 1944, 21, 80-84. The foremost problem of rheology concerns the relation between stress, strain and time in complex materials. There are two ways in which the behaviour of a complex body may be expressed in terms of the Hookean and Newtonian prototypes: the analytical approach regards the material as a physical mixture of ideal Hookean and Newtonian components whereas the integrative view considers the behaviour as intermediate, molecular conditions being regarded as too complex to justify the useful construction of idealised models. Psycho-physical experiments have shown the advantages of the latter approach in studying those industrially important rheological concepts, such as "firmness," which cannot be expressed in dimensionally simple terms. It is unjustifiable to insist on the exclusive use of either method of approach: further experimentation will probably lead to their effective synthesis. C.

**Plastics Models: Use for Stress Analysis.** *British Plastics*, 1944, 16, 199-202. Notes are given on photo-elastic methods, using plastics models, for the analysis of two-dimensional, centrifugal, and three-dimensional stresses. C.

**Paint Moulds: Effect of Zinc Oxide.** S. B. Salvin. *Ind. Eng. Chem.*, 1944, 36, 336-340. Spores of fungi of species commonly found on mildewed paints were sown on paint vehicle constituents, including raw linseed oil and refined and polymerised linseed, tung, soybean and fish oils, together with lead, manganese or cobalt driers, and incubated. Varying degrees of growth were observed, with raw linseed oil providing the most luxuriant development. The effect of nine types of zinc oxide on the growth of common fungi was investigated. The inhibition of fungal growth was found to be a direct function of the surface area of the zinc oxide, a fine-particle-size zinc oxide was particularly effective. Tests showed that although zinc oxide is able to prevent the growth of mycelium or the germination of spores, it is unable to kill the spores and to prevent their germination after removal from the medium and exposure to a more favourable environment. Therefore, zinc oxide cannot be regarded as possessing fungicidal properties; its action is fungistatic. The results of respiration studies indicate that the zinc ion affects the carbohydrate metabolism of the fungus and that this action may be basically responsible for the fungistatic effect. C.

**Propylene-glycol Vapour: Bactericidal Action.** T. T. Puck, O. H. Robertson and H. M. Lemon. *J. Exper. Med.*, 1943, 78, 387-406 (through *Bull. Hygiene*, 1944, 19, 308). Observations of the bactericidal action of propyleneglycol vapour on micro-organisms suspended in air were made in a 60-litre glass chamber and in an experimental room. A given concentration is most effective when the number of bacteria-laden droplets in the air is small, a fact supporting the hypothesis that the glycol acts by condensation on these droplets. Bactericidal action is more rapid at low than at higher temperatures; this again suggests a physical rather than a chemical reaction. High and low humidity are both unfavourable: the optimum humidity for bactericidal action is about

58 per cent. Glycol vapour acts equally well on bacteria suspended for spraying in water, broth, serum broth or saliva. Artificially desiccated bacteria are also killed, but the vapour fails to sterilize an atmosphere contaminated by blowing natural room dust into it. The rate of killing of various Gram-positive cocci at different concentrations is stated: pneumococci are the most susceptible, a concentration of 1 g. in 20 million c.c. of air being rapidly lethal to them. C.

**Silkworm Lecithin: Extraction.** T. Yosida. *Bull. Imp. Sericult. Expt. Sta., Japan*, 1941, 10, 145-146 (through *Chem. Zentr.*, 1941, ii, 1161-1162 and *Chem. Abstr.*, 1944, 38, 1800<sup>3</sup>). The best method of isolating lecithin from silkworm pupae is to extract first with benzene or ether and then treat the extract with 96 per cent. ethyl alcohol at 60°. Variations in method were tried until a pure lecithin with an N:P ratio of 1:1 was obtained. Female pupae yielded a little more lecithin than male pupae. Extracts of male pupae contained an excess of fat acids and extracts of female pupae an excess of lecithinphosphoric acid. C.

**Sodium Hydrosulphite: Determination.** N. Milner. *Textile J. Australia*, 1943, 18, 324 (through *Chem. Abstr.*, 1944, 38, 1705<sup>4</sup>). The method is based on the reaction of iodine with a solution of hydrosulphite in an excess of formaldehyde. Add 20 ml. of 40 per cent. formaldehyde to a 1-l. short-necked volumetric flask and make up with water to approximately 950 ml. Add 10 g. of hydrosulphite, dilute with water to 1 l., close the flask with a stopper and shake it vigorously for 5 min. to prevent the hydrosulphite from forming a cake at the bottom. Allow at least 15 min. for the completion of the reaction. Remove 20 ml. from the flask and add it to 100 ml. of water. Add 50 ml. of 0.1N. iodine, wait 2 min. and titrate back the excess iodine with 0.1N. sodium thiosulphate; 1 c.c. 0.1N. iodine = 0.004352 g. sodium hydrosulphite. A correction should be applied for the loss of sodium hydrosulphite due to oxidation by dissolved air and by the small amount of air in the flask below the stopper before the formaldehyde has had time to act. In practice 1 per cent. is adequate. C.

**Bacterial Cellulose: Structure.** E. Franz, E. Schiebold and C. Weygand. *Naturwissenschaften*, 1943, 31, 350 (through *Chem. Abstr.*, 1944, 37, 1876<sup>6</sup>). Cellulose is separated by *Bact. xylinum* into fibres of considerable length and about 100A. thickness. A photomicrograph of 1:17,000 indicates this clearly. C.

**Corn Starch and Modified Starches: Water Sorption.** I. Sair and W. R. Fetzer. *Ind. Eng. Chem.*, 1944, 36, 316-319. Sorption isotherms of corn starch and ten of its commercial modifications are presented and discussed. Modification up to a 60-fluidity thin-boiling starch results in apparently little change in sorption behaviour. Dextrinization, with or without acid catalyst, results in products with different sorption characteristics. There is little correlation between the viscosity of the modified products and their hygroscopicity. When the moisture contents are compared with that of corn starch at the same humidity the modifications fall roughly into three groups with respect to sorption behaviour: (1) products in which the ratio of water retained is independent of the humidity, e.g. British gum and chlorine-oxidised starch; (2) products in which the ratio varies with the humidity, e.g. 90-fluidity starch, white corn dextrin, canary dextrin, and hypochlorite-oxidised starch; and (3) products in which the ratio continually decreases with decreasing humidity, e.g. the gelatinised corn starch, Amijel. Curves are also given showing the extent of hysteresis in corn starch and some of its modifications. The degree of hysteresis does not appear to be proportional to the sorptive capacity except at high humidities. Observations of the effect of severe desiccation in vacuo on the sorptive behaviour of the products are briefly discussed. C.

**Solutions and Suspensions: Flocculation.** E. Mardles. *Nature*, 1944, 153, 746-747. Flocculation in suspensions of finely divided solids in liquids can be readily demonstrated and is mainly the cause of anomalous viscosity behaviour and thixotropy. Solute particles, whether of sodium chloride, mercuric bromide, soaps or shellac, appear also to be aggregated in some circumstances, and this is demonstrated by comparing the properties of the solutions with those of the suspensions. In suspensions flocculation is associated with a large

sediment volume and a relatively high rate of sedimentation. Graphs are given showing, for solutions and suspensions in ethyl alcohol-water mixtures, the deviation below the mean solubility value of several crystalloids and the deviation above the mean value of sediment volumes of several finely divided pigments. The shapes of the curves are similar, there being a maximum deviation in the neighbourhood of the composition two molecules water, one molecule alcohol. The specific viscosity of solutions of mercuric salts, aluminium chloride, sodium chloride, etc., and of suspensions of zinc oxide, titanium oxide, etc., in alcohol increases with addition of water following the increased viscosity of the medium. The explanation of this behaviour that the higher specific viscosities are due to the longer times of orientation of asymmetric particles in the more viscous liquids can be amplified by assuming the presence of flocks which tend to orientate and break up in the stream of flow. With colloidal solutions of cellulose derivatives, proteins, resins and other large molecule substances in mixed liquids, above a certain concentration the optimum solvent mixture usually yields solutions of minimum viscosity, which are less affected by temperature than those in other mixtures. With the optimum solvent mixture there is the nearest approach to a solution of single molecules. Palit has suggested that the explanation of the viscosity behaviour in mixed liquids has its roots in the gelation (flocculation) capacity of the system, and such solutions above the minimum gelation concentration may be regarded in a limited sense as incipient gels. In other words, in solutions of some concentration and in the poorer solvents, e.g. two molecules water—one molecule alcohol mixture, the solute molecules are to a greater or less extent in an aggregated state. C.

**Radiant Energy: Specification and Measurement.** Committee on Colorimetry, Optical Society of America. *J. Optical Soc. America*, 1944, 34, 183-218. A survey is made of definitions of the quantities and units employed for the specification of radiant energy and the capacities of materials and objects to radiate, modify, and detect radiant energy, and methods and apparatus for the measurement of such quantities. The following are the main headings: radiant flux and radiant intensity; spectral composition and spectral distribution; spatial variants for the specification of radiant energy; reflectance, transmittance, absorptance; importance of spatial conditions of measuring reflectance and transmittance; reflection: Lambert's law and Fresnel's formula; transmission and absorption: Bouguer's and Beer's laws; transmittance, opacity and density; internal transmittance, transmissivity, absorptivity; transmittance and reflectance of turbid media; integration of spectral transmittance, reflectance and absorptance; polarization; polarizing prisms; optical activity and rotatory dispersion; interference of polarized light; elimination of polarization errors in photometry; thermal radiation; spectral emittances of complete radiators; emissivity; radiation and brightness temperatures; colour temperature; radiometry; selective detectors; the modulation of radiant energy; selective filters; photometry; dispersing systems; visual spectrophotometers; photo-electric spectrophotometers; spectrophotometry. C.

**Colour Combinations: Aesthetic Measure.** P. Moon and Domina E. Spencer. *J. Optical Soc. America*, 1944, 34, 234-242. According to Birkhoff, æsthetic measure is equal to the number of elements of order divided by the complexity. The application of this general formula to colour requires the determination of the weights to be given to elements of order and complexity. Such factors as identity, similarity and contrast of hue, value and chroma, ambiguity, and area balance have been evaluated by means of experiments with colour chips. The results of the experiments are summarised, and instructions are given for the calculation of the æsthetic measure of any colour combination. A table of calculated æsthetic measures for various classes of harmonies is given. The ratings lead to the following conclusions: Correctly related grays give essentially as high an æsthetic measure as chromatic colours. A harmony with constant hue tends to be very pleasing. Constant value, on the other hand, tends to give low æsthetic measures. Simple designs with constant hue and constant chroma are often more satisfactory than very complicated combinations with many hues. C.



**Solutions: Light Scattering.** P. Debye. *J. Applied Physics*, 1944, 15, 338-342. The scattering of light in an ideal gas of low density, in liquids, and in solutions is studied and equations are given for the turbidity, which is defined as the fractional decrease of the primary intensity over unit distance. By a combination of the turbidity, with the difference in refraction of solution and solvent, the molecular weight of the substance in solution can be evaluated, without introducing any kind of empirical constants. Scattering by particles of a size comparable with or larger than the wave length of the light is briefly discussed. Information about particle size can be obtained from observations of the dissymmetry in angular distribution of scattered intensity and the dependence of the intensity of scattering in a definite direction on the colour of the primary light. C.

**Polymerised Methyl Methacrylate: Elasto-viscous and Stress-optical Properties.** H. A. Robinson, Ruth Ruggy and Elizabeth Slantz. *J. Applied Physics*, 1944, 15, 343-351. The elasto-viscous and stress-optical properties of commercial methyl methacrylate polymer have been measured at various temperatures. Between 66°C. and 107°C. Young's modulus drops from approximately 400,000 lb. per sq. in. to roughly 200 lb. per sq. in. and the material behaves like rubber. At 93°C. the viscosity is approximately  $10^{12}$  poise. This drops to  $10^9$  at 177°C. Although the curve is not strictly linear with  $1/T$ , an activation energy of 30,000 cal./mole can be deduced for this change. Below 93°C. three rate constants are necessary to describe the delayed elastic process, but two suffice between 93°C. and 135°C. At 149°C. one such constant is enough and above this an instantaneous elastic and a viscous flow are sufficient. The change in rate constants with temperature gives rise to elastic activation energies of 9,000 to 11,000 cal./mol. Polymerised methyl methacrylate is optically negative, but has a stress optical sensitivity about that of glass. The stress optical coefficient varies markedly with temperature, showing a sharp maximum at 93.3°C. The stress-optical coefficient is directly proportional to the average relaxation constant. X-Ray diffraction patterns of methyl methacrylate fibres show four sizes corresponding to spacings of 2.19, 3.07, 6.7 and 14.7 Å. Some slight evidences of crystallinity are shown by diffraction patterns in fibres stretched at 93°C. Fibres stretched at 149°C. show a lesser amount of order in agreement with the birefringence studies. The second-order transition point occurs at 71.1°C. C.

**Rubber: Elasticity; Theory.** H. M. James and E. Guth. *J. Applied Physics*, 1944, 15, 294-303. Natural rubber is the prototype of an important class of materials, all consisting, at least in part, of long flexible molecules. Some of the properties of bulk rubber may be understood by a consideration of the very similar properties of single flexible molecules. In vulcanized materials, in which plasticity is suppressed, intermolecular bonds link the molecules into a coherent network, very irregular in detail but isotropic and homogeneous on the average. In lightly vulcanized materials these bonds are relatively few, and bring relatively small portions of adjacent molecules into fixed relations to each other. For the most part the interaction of neighbouring molecules in the material is that characteristic of liquids. It is the presence of the intermolecular bonds, which link the molecules into a network and thus control its form, that differentiates rubber-like materials from liquids and it is the small number of these bonds, and their weak control of the form of material through the entropy rather than the internal energy, which differentiates rubber-like materials from ordinary solids. On the basis of this picture of the structure of rubber there is derived a form for the stress/strain curves at moderate extensions which is in good agreement with experiment. C.

**Rubber-like Materials: Hysteretic and Elastic Properties.** J. H. Dillon, I. B. Prettyman and G. L. Hall. *J. Applied Physics*, 1944, 15, 309-323. The nature of hysteresis in products such as pneumatic tyres, solid tyres, and transmission belts is analysed and the requirements of a laboratory test for evaluating the relative hysteretic characteristics of natural and synthetic rubber stocks are developed. The significance of various definitions of the "hysteresis defect" on rubber-like materials is discussed. A forced resonance vibrator in which rubber samples are deformed in shear at frequencies of 20 to 300 cycles/sec., shear strains of 0.05 to 0.35, and temperatures of -20 to +120°C. is



described. Experimental results obtained with natural rubber and GR—S gum and tread stocks are presented. The hysteresis index  $\omega\eta$  is nearly independent of dynamic shear strain whilst the dynamic modulus  $G$  depends upon the ratio of height to diameter of cylindrical samples. These results are at variance with those obtained by previous investigators who, employing compressive vibrations, have reported marked dependence of both modulus and friction upon dynamic strain and the "shape factor" of tread type stocks. In agreement with previously reported work,  $G$  is found to be independent of frequency and  $\omega\eta$  only slightly dependent upon frequency, for tread type stocks. C.

**Fats, Oils and Soaps: Review of Literature for 1943.** M. M. Piskur. *Oil and Soap*, 1944, 21, 65-72, 108-123. The literature is reviewed under the headings: General; technical treatment; products (except detergents); deterioration; biochemical; characteristics and composition; detergents. W.

**Mineral and Trace Element Metabolism in Animals and its Relation to Deficiency Diseases.** S. J. Watson. *Chem. & Ind.*, 1944, No. 15, 138-141. Knowledge of the physiological action of mineral elements is scanty. Trace elements appear to act as catalysts and to be bound up with the enzyme systems of the cell. Ruminants suffer much more from their deficiency than do the simple stomached animals. Work on "pine" diseases in sheep in various parts of the world is surveyed. These are curable by the administration of copper or cobalt or both, but so little is known of the interaction and antagonism of the different trace elements that care must be exercised in their use. W.

#### PATENTS

**Chlorine Dioxide: Production.** Mathieson Alkali Works. B.P.561,170 of 28/10/1942:8/5/1944 (Conv. 26/9/1941). Chlorine dioxide substantially free from chlorine is produced by treating a metal chlorate with sulphuric acid in the presence of a persulphate, preferably in proportion approximately equivalent to that of the chlorate, at a temperature not substantially exceeding 50° C. C.

**Starch Syrups: Preparation.** A. E. A. Beaver and Corn Products Co. Ltd. B.P.561,706 of 11/11/1942:1/6/1944. For the manufacture of syrups from starch, a starch suspension is first subjected to the action of a bacterial enzyme, e.g. an enzyme derived from *B. subtilis*, *B. vulgatus* or *B. mycoides*, which is capable of reacting with starch in water suspensions and destroying the gelatinising properties. The starch is then saccharified by malt or other vegetable diastatic inversion. The process can be applied usefully to starch suspensions above 7° Bé., and is particularly advantageous with relatively heavy suspensions. The proportion of malt diastase required in this process is considerably less than is customary in diastase inversion and may be of the order of 5 per cent. or more. C.

**Carob Gum: Improvement of Gelling Properties.** K. Brauer (Tel-Aviv, Palestine). B.P.561,762 of 18/12/1942:2/6/1944 (Conv. 20/12/1941). Carob gum is subjected to treatment with hot solutions or suspensions of bases or alkaline reacting salts, e.g. sodium hydroxide, in ethyl or methyl alcohol or a like solvent. Salts of calcium or iron may be used as catalysts. After washing and drying, there is obtained a powder which forms a jelly when mixed in the usual manner with water, the jelly being similar to those prepared with agar-agar or pectin. C.

### 10—ECONOMICS

**American Wool Council: Operations in 1943.** F. E. Ackerman. *Natl. Wool Grower*, 1944, 34, No. 2, 17-18. W.

**American Viscose Yarns: List Prices.** *Rayon Organon*, 1944, 15, 34-36. List prices at various dates between September, 1919, and September, 1941, are tabulated for American yarns for weaving, of 50, 75, 100, 125, 150, 200, 300 and higher deniers. C.

**Cotton Lint: Consumption in the United States, 1913-1943.** *Rayon Organon*, 1944, 15, 28. American monthly lint cotton consumption figures are given for the period 1913-1943. C.

**Cotton, Wool, Silk and Rayon: Spot Prices, 1914-1941.** *Rayon Organon*, 1944, 15, 24-25. Monthly average spot prices of raw cotton, scoured raw wool, raw silk, and rayon filament yarn are tabulated for the period 1914-1941. C.

**Raw Silk: Consumption in the United States, 1920-1941.** *Rayon Organon*, 1944, 15, 26. Monthly deliveries of raw silk to United States mills are tabulated for the period 1920-1941, and annual consumption and re-export figures are given. C.

**Rayon: Consumption and Production in Canada.** *Rayon Organon*, 1944, 15, 54-55. A table is given showing Canadian production of viscose and acetate yarns, and filament yarn and staple fibre imports and consumption in the years 1925 to 1943. Total rayon filament yarn and staple fibre consumption in Canada in 1943 amounted to 27,073,395 lb., 0.8 per cent. above the 1942 consumption and 75 per cent. above consumption in 1938. Total domestic viscose and acetate yarn production declined from 18,450,000 lb. in 1942 to 16,550,000 lb. in 1943, but imports increased from 3,530,634 lb. to 4,823,419 lb. Courtaulds' (Canada) Ltd. production of viscose yarn declined from 11,250,000 lb. in 1942 to 9,350,000 lb. in 1943. The estimated production of Canadian Celanese Ltd. (7,200,000 lb. of acetate yarn) remained unchanged from the previous year. Approximately 13 per cent., or 2,600,000 lb., of the total yarn supply, excepting imports of acetate yarn from Britain, was delivered to the full-fashioned hosiery industry. Staple fibre imports during 1943 reached 5,699,976 lb., compared with 4,881,989 lb. in 1942, an increase of 17 per cent. Approximately 95 per cent. of Canada's staple fibre imports were from Britain. C.

**Rayon: Production and Consumption in the United States.** *Rayon Organon*, 1944, 15, 15a-19. Tables and graphs are given showing annual productions of rayon filament yarn and staple fibre during the period 1911-1943, and the distribution of domestic rayon consumption by trades and of yarn production by denier in recent years. Total rayon production (yarn and staple fibre) in the United States in 1943 reached a record figure of 663,100,000 lb., an increase of 5 per cent. over that of the previous year. Compared with the 1942 figures, viscose + cuprammonium filament output showed an increase of 9 per cent., acetate a decline of 4 per cent., and rayon staple an increase of 6 per cent. in 1943. Viscose and cuprammonium yarn consumption increased in tyre production and broad and narrow fabric weaving sections. Notable increases occurred in acetate filament consumption in the hosiery trade. The average denier of the viscose and cuprammonium yarn production in 1943 was 157 denier, compared with 140 denier in 1942 and 139 denier in 1941. C.

**Textile Fibres: Consumption in United States.** *Rayon Organon*, 1944, 15, 20-21, 44-47. (1) Monthly consumption figures and consumption or activity indices are given for cotton, silk, wool and rayon for the period 1925-1943. (2) Tables and graphs are given showing annual consumptions of cotton, wool, rayon and silk in the United States in the period 1920-1943. In 1943, total fibre consumption reached 6,520,400,000 lb., a decline of 4.8 per cent. from the previous record year. Consumption of cotton, at 5,236,400,000 lb., showed a drop of 6.7 per cent., scoured wool (627,900,000 lb.), an increase of 2.3 per cent., and rayon (656,100,000 lb.), an increase of 5.7 per cent., compared with the corresponding figures for 1942. Very small amounts of silk were imported from Italy and China. C.

**United States Rayon Filament Yarn Exports.** *Rayon Organon*, 1944, 15, 25. Annual exports of rayon filament yarn for 1925-1941, monthly exports for 1929-1941, and annual exports by countries of destination for 1925-1941 are tabulated. C.

**United States Rayon Imports.** *Rayon Organon*, 1944, 15, 22-23. Tables are given showing annual imports of rayon filament yarn, staple fibre and waste (in pounds and dollars) for 1922-1941, monthly imports of rayon filament yarn, staple fibre and waste for 1929-1941, annual imports for consumption of rayon staple fibre by countries of origin 1928-1941, and annual general imports and imports for consumption of rayon filament yarn and rayon waste by countries of origin, 1922-1941. C.

**Plastics and their Raw Materials: Development.** H. Levinstein. *Chemistry and Industry*, 1944 226-230. Available supplies of calcium carbide in Britain, coal, petroleum, and fermentation products as raw materials for the plastics industry, hydrogen, methane, and ethylene in coal or coke oven gas as raw materials, and problems of price and supply are reviewed. Developments in

plastics, rayon and synthetic rubber industries in the United States, Germany and Japan are briefly considered. The correlation of the plastics industry with other industries is discussed, and requirements for the rapid development of the British plastics industry are outlined. A bibliography, divided into sections relating to coal, methane, and petroleum, respectively, as sources of raw materials for chemical industry, is given. C.

**Rationed Clothing, Footwear and Textiles: Retail Outlets.** *Bd. Trade J.*, 1944, 150, 201-205. In May, 1942, traders handling goods controlled by the Consumer Rationing Order (clothing, footwear, hand-knitting yarn and dress materials) were required to open a coupon account at a bank. From the forms of application submitted by retailers, statistics have been compiled showing the numbers of such shops and analyses by size and type. By the middle of 1942, 86,150 retail shops had opened accounts; of these about 81,000 were primarily engaged in selling rationed clothing and textiles, the remaining 5,000 dealing in clothing only as a side-line. It is estimated that possibly 10 per cent. of shops wholly or mainly selling rationed goods may not have opened accounts, these being mainly very small shops. Of the 86,150 shops, 9 per cent. have total sales amounting to more than £12,000 per annum, 43 per cent. have turnovers of £2,500-£12,000, and 48 per cent. under £2,500 per annum. The distribution according to types is 10 per cent. multiple shops, 3 per cent. co-operative stores, and 87 per cent. independent shops. The multiple and co-operative shops fall almost entirely in the two upper turnover classes. Classifications according to the lines of goods sold and according to general descriptions, and the distribution of shops by the lines they handle in each of the Civil Defence regions are shown, together with estimates of the population per shop in the various regions. For the United Kingdom as a whole the average number of persons to a shop in 1942 was 521. The number of persons per shop was generally higher in the southern part of the country than in the north. C.

**Textile Wholesale Prices, May, 1944.** *Bd. Trade J.*, 1944, 150, 221. The wholesale price index numbers for May are Cotton 159·3, Wool 183·9, Other textiles 134·3 (1930=100). C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY AND EDUCATION

**Tootal Broadhurst Lee Co. Mill School: Organisation.** J. E. Townsend. "*Times*" *Trade & Engineering*, 1944, 55, May, p. 23 and 47. For many years it has been the policy of the Tootal Broadhurst Lee Co. to assist young people joining its business to continue their academic education after leaving school and at its Bolton Mills it has its own part-time day continuation school, which has continued without interruption since 1918. The curriculum is entirely non-vocational, and for boys embraces mathematics, sciences, English composition, history, geography, literature, drawing, woodwork, and physical exercises. Girls exclude woodwork, but instead take hygiene, housewifery, household accounts, needlework, and cookery. The school is provided by the company, is fully staffed by qualified teachers, and is under the inspection of the Board of Education. All employees at the firm's Bolton Mills under the age of 16 must attend this school two half-days a week up to the age of 18 years. All instruction, school materials and school costumes, full dental and minor medical treatment are provided free. Wages are made up for the time spent in the school. It is generally acknowledged that the improvement in the girls and boys, mentally, physically and socially, has been most marked. The firm's guidance and assistance are also given for the operatives to continue their studies at local evening technical classes. In Manchester, girl operatives at the mills and works have been attending (until they attain 18 years of age) the local day continuation school. Young employees in the distributing warehouse and offices are sent either to a day continuation school or to part-time day classes at the High School of Commerce, according to the standard of education they have already reached. In addition to these non-vocational studies, a vocational training scheme has recently been introduced for the Manchester staff. The entrants are divided into three groups: Class A—the elementary school, boys and girls; Class B—secondary school, boys and girls; Class C—

university graduates. This scheme covers a period of years and provides the basis of a vocational training upon which the student can later build his specialized study. It is possible for a bright child from an elementary school to pass forward into the later stages of the training and onwards to a university degree. Over 20 years ago the firm established laboratories at its headquarters and mills. In its Manchester laboratories alone there is a normal staff of 40 fully qualified scientists, whose functions include pure research and the maintenance and improvement of the quality of the firm's production. Whilst the firm uses the services of designers from all over the world, a large proportion of the patterns and designs for its fabrics are produced in its own art departments in Manchester and London. In addition it has a special staff for the designing of model gowns. C.

**Chilean Textile Factories: Health Hazards.** A. Forero and J. Thomas. *Rev. Chilena de Hig. e Med. Preventiva*, 1943, 5, 359-386 (through *Bull. Hygiene*, 1944, 19, 287-288). A report is given of a study of 282 factories in Chile, employing 8,770 operatives and processing chiefly cotton, jute, hemp, vegetable silk, wool, goat, llama and rabbit hairs, and rayons. The various processes are briefly reviewed and the hazards from the dust and fibres, mainly respiratory, bronchitis, allergic symptoms, byssinosis, and conjunctivitis, are discussed. Hemp fibre causes a disease which is similar to silicosis. Skin conditions arise from the dyes and from chlorine, alkalis, acids and benzole. Risks are greatest in carding and dyeing rooms. Illustrations (in the original paper) show how the masses of dust collect, the masks used, the structure of the constituent filters and the quantity of dust thereby removed from the inspired air. C.

**Nitrous Fumes in the Atmosphere: Permissible Limits.** C. P. McCord. *Industrial Standardization*, 1944, 15, 41. Permitted concentrations of nitrous fumes range from 1 part per million (Soviet Russia) to 1400 p.p.m. (a non-official German standard), but 39 p.p.m. is the commonest figure. The American Standards Association, on the recommendation of the American Association of Industrial Physicians and Surgeons have now fixed 25 p.p.m. as the limit. The toxic effects of nitrous fumes are briefly described. C.

**Toxic Anæmia: Causes and Occurrence.** Ethel Browning. *J. Ind. Hyg. & Toxicol.*, 1943, 25, 124-131 (through *Bull. Hygiene*, 1944, 19, 283). Toxic anæmia, which is notifiable under the British Factories Act, may be regarded as a dyshaematopoietic anæmia. Industrial toxic agents act on the bone marrow to produce a wide variation of disturbance according to the composition of the agent, the severity of exposure, and the susceptibility of the victim. Benzole with heavy exposure causes severe leucopenia with a total white cell count as low as 104 per cu. mm.; with milder exposure leucopenia is not a predominant feature, but relative lymphocytosis occurs. Xylol produces an effect similar to, though less severe than, that of benzole. Carbon tetrachloride is not primarily dyshaematopoietic, but it may cause secondary anæmia; one case, however, is quoted of fatal jaundice where the bone marrow was definitely hyperplastic. Solvent naphtha contains not more than 2 per cent. of benzole and toluole; it may originate slight secondary anæmia, but no effects comparable with those due to benzole or toluole. Trichlorethylene is not usually considered a blood poison, but two cases, one of fatal aplastic anæmia, the other of severe hypoplastic anæmia, have been ascribed to it. Mixed solvents and thinners (mixtures of hydrocarbons, chloro compounds and ketones) used in spraying with cellulose are not so insidiously dangerous as the benzole group; they cause malaise before doing serious harm. Two cases, one fatal, of myeloid leukaemia are quoted, due to using, for cleansing purposes, thinners containing some benzol. Radio-active substances for luminizing dials are used with strict precautionary measures and so far, no toxic results giving cause for alarm have occurred in Britain. Some relative lymphocytosis has been observed, due, possibly, to a hyperstimulative influence on the haematopoietic system. C.

**Post-war Textile Research.** P. Larose. *Canadian Text. J.*, 1944, 61, No. 9, 47-48. The need is stressed for more intensive post-war textile research, and the range of problems requiring investigation briefly indicated. W.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL

**Bacteria Responsible for the Loosening of Wool on Sheepskins.** M. E. Maxwell and F. G. Lennox. *Nature*, 1944, 154, 118-119. Two new experimental methods for investigating the sweating process of fellmongering are: (1) following the course of wool loosening by measuring the depilation load, and (2) sterilizing sheepskin and removing the sterilizing agent to permit investigation of the wool-loosening activity of pure cultures of bacteria. Sterilizing in this way and measuring the depilation load during incubation at 25° C. after inoculation with pure cultures of bacteria, showed, that of the 75 species and strains of bacteria occurring on sheepskins, only 4 reduced the depilation load to zero within 41 hr. *Proteus vulgaris* is probably the principal sweating bacterium. W.

**"Stickers."** *Sheep Breeder*, 1943, 63, No. 11, 5-6 (through *Biol. Abs.*, 1944, 18, F, 6693). Stickers, the spear-pointed seeds of a number of weeds, are of considerable economic importance to the sheep industry. Regions of the body most affected and the lesions caused are described. Suggestions are given which if followed should reduce the losses to the livestock and meat industry. W.

**Nutritional Anæmia of Sheep on Granite Pastures of New Zealand (N.S.W.): Experiments with Mineral Licks.** W. L. Hindmarsh. *Agric. Gazette, New South Wales*, 1944, 55, 123-126. The administration of various minerals known to be lacking in the soil and pasture did not appreciably affect the health, condition and wool production of comparable groups of sheep. Comparison with similar sheep grazed on improved pasture suggests that the sheep do not lack any specific substance or mineral in the winter diet, but merely require good food. W.

**Increasing Clean Fleece Weights.** R. H. Burns. *Natl. Wool Grower*, 1944, 34, No. 1, 18-19. A study of the amount of clean wool per sheep in Wyoming flocks since 1940. Wyoming ranks first in the U.S.A. for greasy fleece weight per sheep (9.8 lb. in 1943). The methods suggested by the Wool Department at Wyoming University for increasing the clean yield of Wyoming flocks are listed. W.

**Wool Clips: Preparation.** A. Johnston. *Natl. Wool Grower*, 1944, 34, No. 3, 25. Wool clips should be prepared in a manner acceptable to the wool trade, and the necessary recommendations are made. This is especially important in view of the core-sampling tests for determination of yield to be undertaken by the Wool Division of the Livestock and Meats Branch, Office of Distribution, War Food Administration, U.S.A. W.

**Sheep Shearing in India.** P. N. Nanda and G. Singh. *Indian Fmg.*, 1943, 4, 188-200. Details are given of the basis of valuation of wool for purchase, 25 per cent. of the marks being allotted to clean yield which depends solely on efficient shearing. Unless climatic conditions are unfavourable, it is advantageous to shear twice a year. Times for shearing, preparation for shearing and the operation itself are discussed. W.

**Skinfolds in Sheep.** M. A. Madsen, A. C. Esplin and R. W. Phillips. *Utah State Agric. College, Agric. Exper. Sta., Bull.* 307, 1943. The literature is reviewed on the relation of skinfolds to wool production, their inheritance, and the effect of nutrition on their development. From a study of the flock of Rambouillet ewes at the Utah State Agricultural College, information is given on the inheritance of skinfolds and the value of early estimates of their amount

for predicting this character in yearlings, the applications of these findings to sheep breeding being discussed. W.

(C)—VEGETABLE

**Dholleras Cotton: Improvement.** *Indian Farming*, 1943, 4, 468-469. Wagad cotton forms the essential constituent of commercial Dholleras cotton. With a ginning outturn of 39 per cent. and a staple length of  $\frac{3}{4}$  in., Wagad is capable of spinning 13s highest standard warp counts and is both hardy and resistant to adverse climatic conditions. The Lalio or Broach *desi* and Goghari mixture which forms a second constituent of Dholleras cotton is of the same general character as Wagad. A third constituent is Mathio, a hardy early variety of *arboreum* cotton which gives a coarse type of lint of low spinning value. Attempts to improve Wagad cotton have resulted in the selection of a strain known as Wagad 8 which is superior to local Wagad. Schemes for the improvement of Wagad and the replacement of Mathio are now in operation. A few selections from local Wagad have been obtained which are good in respect of staple length and spinning performance. A segregate 4-1 from the back-cross (Wagad 8  $\times$  1027 ALF)  $\times$  Wagad 8 is capable of spinning up to 16s warp counts and is considered to be a profitable type for general cultivation. The segregate 7-1, isolated from the cross Wagad  $\times$  1027 ALF, has done well in the Lalio tract around Mehsana. Mathio is being replaced by the Bengals strain C520 which is superior in yield, ginning percentage and quality. C.

**Improved Indian Cottons: Cultivation in United Provinces, India.** B. L. Sethi and M. A. A. Ansari. *Indian Farming*, 1943, 4, 461-462. Details are given of the characteristics of the improved types of cotton, C520 and Perso-American, now being grown in the United Provinces. C520, a single-line selection from indigenous material, is an early hardy variety with a ginning percentage of 35.5 and a staple length of 0.76 in.; it is capable of spinning up to 13s warp counts. Perso-American is a single-line selection from exotic material (*G. hirsutum*) imported from Iran. It is a high-yielding and early variety with a ginning percentage of 32 and a staple length of 0.88 in. and is capable of spinning up to 32s warp counts. The results of tests demonstrating the superiority of these varieties over local *desi* in yield and quality are given. During the past eight years the area under C520 has extended from 17,419 to 33,231 acres. The area under Perso-American has increased from almost nil to 12,000 acres in the past four years. Seed supply and marketing schemes are described. C.

**Bollworm, Boll Weevil, Cotton Aphid and Flea Hopper: Control.** K. P. Ewing and R. W. Moreland. *J. Econ. Entom.*, 1942, 35, 626-629 (through *Brit. Chem. Physiol. Abstr.*, 1944, B III, 89). Basic copper arsenate-sulphur or calcium oxide dusts gave higher cotton yields than lead or calcium arsenate or cryolite in control of the bollworm and boll weevil, and higher yields than sulphur or sulphur-arsenical mixtures in flea hopper control. Increase in aphids after dusting with basic calcium arsenate-sulphur was more than 50 per cent. of that following calcium arsenate or zinc-softened calcium arsenate dusts. Addition of rotenone (0.5 per cent.) to calcium arsenate dust left 3.6 times as many aphids on cotton as did addition of 1 per cent. of nicotine. Calcium arsenate-zinc sulphate was not a satisfactory aphicide. C.

**Cotton Aphid and Boll Weevil: Control.** I. J. Becnel and E. H. Floyd. *J. Econ. Entom.*, 1942, 35, 623-626 (through *Brit. Chem. Physiol. Abstr.*, 1944, B III, 89). The effects of calcium arsenate, with and without sulphur (10 per cent.) and rotenone (0.5 per cent.), nicotine (1 per cent.), and sulphur (10 per cent.) plus pyrethrins (0.2 per cent.) on the cotton aphid and boll weevil, and on yield of seed cotton, are discussed. C.

**Hemipterous Cotton Insects: Control.** J. R. Eyer and J. T. Medler. *J. Econ. Entom.*, 1942, 35, 630-634 (through *Brit. Chem. Physiol. Abstr.*, 1944, B III, 89). Preventive applications of Paris green-sulphur dusts for hemiptera control gave an increase in yield of 246 lb. of seed cotton per acre. Smaller gains were obtained by dusting with calcium arsenate-sulphur and sulphur-resin mixtures. The arsenical-sulphur combinations also gave high mortality of *Chlorochroa sayi*, *Lygus hesperus*, and *Adelphocoris superbus* in large field cages. C.

**Cotton Plant Puller: Application.** C. V. Sane. *Indian Farming*, 1943, 4, 602-603. Serious damage to the cotton crop in Gujarat is caused by the spotted bollworm. The usual method of dealing with the old cotton stalks was to hack

them with a spade which left all the underground root system intact. In the soils of Gujarat these soon produced secondary growth giving to the bollworm shelter and food and an opportunity to continue the brood. The plant puller takes away the main root system along with the stalk, so that secondary shoots do not come up. In addition to depriving the bollworm of food and shelter in this way, the use of the plant puller makes easier the working of the land after rain by other cultural implements. Certain objections that have been raised to the use of the puller are discussed and answered. The encouragement of its general adoption by propaganda and legislation is discussed and progress in the Navsari and Baroda districts is described. C.

**American Cotton: Production, 1943-44.** U.S. Dept. Agric. Crop Reporting Board. *Textile Weekly*, 1944, 34, 98, 100. Statistics of acreage, yield per acre and ginnings are tabulated for the different cotton-growing States, 1942 and 1943. The total area harvested in the 1943-44 season was 21,652,000 acres, the average yield 253.5 lb. per acre, and the total of ginned cotton 11,427,000 bales (500 lb.). This includes some 300 bales of Sea Island cotton and 60,900 bales of American-Egyptian. Another table gives the values of cotton lint and cottonseed for the different States. C.

(D)—ARTIFICIAL

**Tantalum Spinneret Cups: Production.** C. C. Downie. *Silk & Rayon*, 1944, 18, 661-2. A general account is given of the properties of tantalum and its fabrication into rayon spinneret cups. C.

PATENTS

**Modified Regenerated Cellulose Fibres and Films: Production.** E. I. Du Pont de Nemours & Co. B.P.562,184 of 27/11/1942:21/6/1944 (Conv. 27/11/1941). Cellulosic fibres, yarns, films and other structures which are capable of being dyed with wool dyes, particularly "neutral" dyeing wool dyes, are produced by spinning an aqueous alkaline solution of cellulose, e.g. viscose, into which has been incorporated a water-soluble polymer having an intrinsic viscosity of at least 0.5 and comprising the reaction product of a substantially equimolecular mixture of a dibasic carboxylic acid and a diamine containing at least two oxygen atoms in the chain separating the amine groups. The best results are obtained by incorporating into the viscose about 5-20 per cent. of the polymer based on the weight of the cellulose in the viscose. Dyeings made with wool dyes are practically as fast to washing as similar dyeings on wool and superior to dyeings on regenerated cellulose materials containing basifying agents of the protein type. C.

**Cotton Plant Dusting Device.** C. W. McLaughlin. U.S.P.2,336,113. The claim is for a unit duster that can be readily mounted on an agricultural vehicle for feeding [insecticidal] dust to a set of nozzles connected to a conduit that extends laterally from the main part of the apparatus. A motor-driven fan is mounted in this part to force the dust to the conduit through semicircular openings that can be closed by a slide valve. C.

**Cellulose Ester: Melt Spinning.** Herculese Powder Co. U.S.P.2,336,159. Thin filaments of a cellulose lower fatty acid ester are obtained without the use of solvents or plasticizers by extruding the semi-fluid mass at 425-560° F. through an orifice, and stretching and cooling. The combined effect of time and temperature is such that the decrease in specific viscosity of the ester is less than 50 per cent. C.

**Cuprammonium Cellulose Spinning Solution: Preparation.** Industrial Rayon Corporation. U.S.P.2,336,481. A mixture of ammonia solution, copper hydroxide and cellulose in the ratio  $\text{NH}_3:\text{Cu}(\text{OH})_2$ : dry cellulose of 0.5—0.8:0.6:1 is agitated at a temperature of less than 10° C., maintained by external cooling. C.

**Fabric Spinning Apparatus.** F. W. Manning. U.S.P.2,336,743. A thermoplastic material is extruded through a spinneret in a chamber on to a retaining wall on which the filaments are deposited, while still plastic enough to adhere together, in such a manner that they interlace and form a pervious web. The apparatus is shown in a diagram. C.

**Tampon Spinning Apparatus.** F. W. Manning. U.S.P.2,336,744. Tampons with pull cords are made by sifting an absorbent material at uniform intervals



through a primary foraminous wall to form pads on an adjacent secondary foraminous wall about a central cord, removing the pads and compressing them into relatively rigid cartridges, and then spinning a web of filaments over each cartridge. The apparatus is shown in a diagram. C.

**Fabric Spinning Apparatus.** F. W. Manning. U.S.P.2,336,745. The filament from a spinneret passes through an ejector where it is disrupted by means of an elastic fluid, and the stream of fluid is made to deposit the reduced filaments upon a foraminous wall as a homogeneous web. The apparatus is shown in a diagram. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Compressed Cotton: Opening.** *Cotton (U.S.)*, 1944, 108, No. 3, 134-135. A correspondent gives particulars, with diagrams of his machinery lay-out, of methods for opening compressed cotton. *High-density bales* (32 lb. per cubic ft., 15½ cub. ft. per bale) are opened 100 at a time. The cotton is pulled off in strips and fed to a series of five hoppers. It is then carried by a lattice to a vertical opener (at 550 r.p.m.) and to a down-stroke beater (at 400 r.p.m.). The loosened cotton then travels through about 40 feet of "gyrator" to a press where it is made up again into bales of the standard size but weighing only 350-400 lb., and bound by 3 or 4 ties only. These loose bales are then treated like the ordinary "flat" or "country" bales (14 lb. per cub. ft.; 45 cub. ft. per bale) but are first stored for at least 24 hours, which is claimed to increase production at the card by about 4 lb. per hour. (The cotton used by the mill is 1⅜-in. strict middling, or better.) *Standard compressed bales* (22 lb. per cub. ft.; 22½ cub. ft. per bale) are opened 40 at a time. Four bale breakers feed the cotton *via* a conveyor belt, gyrator and three hoppers to three Aldrich beaters (1,000 r.p.m.) and vertical openers (550 r.p.m.) and thence through trunks to the scutcher hoppers. When these hoppers get full, the hoppers before the beaters stop, and when these fill up the bale breakers stop. (The standard compressed cotton used in this mill is Western, 1-in. staple, and strict low bright in grade.) C.

**Drawframe Rollers: Effect of Setting on Spinning Breakages.** H. L. Pratt. *Cotton (U.S.)*, 1944, 108, No. 4, 104-105. A report is given of counts of "ends down" each hour over a period of 8 hours when spinning 7s yarn from 45 bales of a mixing of American cottons, the variant being the settings of the draw-frame rollers. These were as follows (S=staple length of cotton):—

	Usual.		1st Alternative.		2nd Alternative.
Front to 2nd ...	$S + \frac{1}{16}$ in.	...	$S + \frac{1}{16}$ in.	...	$S + \frac{1}{16}$ in.
2nd to 3rd ...	$S + \frac{1}{16}$	...	$S + \frac{1}{16}$	...	$S + \frac{1}{16}$
3rd to back ...	$S + \frac{3}{8}$	...	$S + \frac{1}{4}$	...	$S + \frac{1}{8}$

The roller diameters from front to back were 1½, 1½, 1½, 1½ ins. Other machine particulars are fully recorded. The average numbers of "ends down" per 1,000 spindle hours were 32.4, 24.9 and 20.8 for the usual and the 1st and 2nd alternatives, respectively. C.

### (B)—SPINNING AND DOUBLING

**"Accotex" Roller Covering.** Armstrong Cork Co. Inc. *India-Rubber J.*, 1944, 106, 705. An announcement of a new material for roller covering, made of a mixture of cork and synthetic rubber. It is not thermoplastic and resists sticking, flattening, dye liquors, and solvents. It may be buffed again three or four times when worn. It is seamless and is fixed to the rollers by glueing. C.

## PATENTS

**Wool Combing Machines.** Taylor, Wordsworth & Co. Ltd. and F. Denham. B.P.560,991 of 1/5/1944. The revolvable large and small circles of a Noble or similar wool comb are heated by means of electrical elements located in stationary annular housings disposed below each of the gear wheels supporting the circles. W.

**Cork Spinning Roller Cot: Production.** Armstrong Cork Co. U.S.P.2,336,193. A mixture of granulated cork and binder is extruded into roller cots having a density of 26 lb. per cubic foot or more. C.



**Spinning Spindle.** H. & B. American Machine Co. U.S.P.2,336,593. The spindle is fitted with resilient means that permit a limited downward movement of the bolster to compensate for the gradual descent of the blade into the bolster case as the friction member between the whorl and the flange wears away. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Silk Hosiery Yarn: Preparation.** G. A. Urlaub. *Amer. Dyes. Rept.*, 1941, 30, 206-210. Differences between deliveries of silk, such as differences in denier and in gum hardness, and their effects on subsequent processes, particularly boiling-off and dyeing, and on finished products are discussed. The importance of not mixing different lots is emphasized. Soaking, winding and coning operations are discussed and the causes and prevention of various faults considered. Softeners, lubricants and other materials put on by throwsters and knitters are mentioned. These must be removed from silk hosiery in the boil-out prior to dyeing, and it is suggested that dyers should be supplied with details of the yarn construction and preliminary treatment in order to facilitate the determination of the most suitable boil-off and dyeing procedures. The processing of nylon yarn is briefly considered in relation to the dyeing of nylon hosiery. C.

#### (C)—WEAVING

**Cotton Crêpe Fabrics: Weaving.** *Textile Weekly*, 1944, 33, 954-960. Practical hints are given on the choice of the loom and reed and on setting the various mechanisms for weaving cotton crêpes. C.

**Loom Driving Belts: Management.** *Textile Weekly*, 1944, 34, 112-116. Practical hints are given on the arrangement and care of belts for the ordinary and half-cross drives. C.

**Looms: Maintenance.** E. L. Frankl. *Cotton (U.S.)*, 1944, 108, No. 4, 101. The writer advocates a system of loom overhauling in which, instead of completely dismantling and reassembling the loom at intervals of some years, the mechanism is dealt with sectionally, closely associated parts being overhauled by separate teams at regular intervals. It is claimed that more uniform settings are thus achieved and the looms are kept in good order with a minimum staff. C.

#### PATENTS

**Resilient Pile Fabric.** Boothroyd Rugs Ltd. and J. I. Boothroyd. B.P.561,805 of 26/10/1942:6/6/1944. A resilient fabric comprises two ground cloths spaced apart from one another and interconnected by pile threads constructed from resilient fibre, e.g. mohair, crossbred wool, or resilient rayon, which cross one another between the ground cloths and are interwoven with the threads in a W or M formation, the object being to produce a combination of thread groupings which will give a maximum cellular construction. For this purpose a pile fabric woven double or face to face on a double shuttle, double plush loom has one pile thread of two crossing pile threads, or one group of pile threads of two crossing groups of pile threads passing over one pick, under two picks and over one pick in the ground cloth, then under one pick, over two picks and under one pick in the other ground cloth, and repeats this sequence in regular order, the other crossing pile thread or group passing under one pick, over two picks and under one pick in the lower ground cloth, then over one pick, under two picks and over one pick in the upper ground cloth. The crossing pile threads in one row alternate with those in the next row, each pile thread being composed of a number of threads or strands of resilient fibres or filaments, the crossing pile threads passing in opposite directions between the same picks in the two ground cloths, thereby obtaining a double number of threads or strands at each crossing. C.

**Shuttle Tongue.** Kirk & Co. (Blackburn) Ltd., H. Wrigley and F. Haworth. B.P.561,847 of 24/11/1942:7/6/1944. A shuttle of the type having a short metal peg, which is rigidly secured in the head and projects into the pirn or bobbin, is provided with pirn or bobbin retaining means comprising a cup slidably mounted on the peg into which the flanged base of the pirn or bobbin fits, the sides of the cup being so shaped in relation to the base of the pirn or bobbin that there is no relative rotary movement between them, a two-armed clip secured to the head of the shuttle, the arms of which enter the groove behind the flange on the base of the pirn or bobbin, two diametrically opposite

edges of the cup being formed with projections adapted to enter holes or slots in the arms of the clip when the pirn or bobbin is in the weaving position to prevent rotation of the cup on the peg, and a spring holding the cup against the arms of the clip to retain the projections in the holes or slots in the arms but against the pressure of which the cup can be pressed back to release the projections and allow the cup and pirn or bobbin to be rotated on the peg for removal of the former from the latter. C.

**Circular Knitting Machine.** R. Kretser (U.S.A.). B.P.561,907 of 25/9/1942: 9/6/1944. Circular knitting apparatus combines a needle bed, cam means for raising selected needles to latch clearing position, the cam means and needle bed being movable relative to one another, stationary yarn guiding means for feeding yarn exclusively to the selected needles raised by the cam means, and cam means and yarn guides for raising and feeding other selected needles in latch clearing position arranged in fixed relation to the first cam means. A spool rack and associated series of yarn spacing and guiding means may be provided, wherein each series of yarn guiding means lies in a straight row which is at a relatively small angle to an intersecting radius of the needle cylinder. This arrangement makes possible the production of a knitted fabric in which all the stitches in a large and commercial width fabric may comprise a mixture of coursewise and vertical or wale-wise stitches staggered in diagonal or herringbone or basket stitch formations. C.

**Cemented Pile Fabric Yarn or Fibre Supplying Mechanism.** M. Strode. B.P.562,086 of 16/7/1942:16/6/1944. Mechanism for supplying a warp of yarn or bat of unspun fibres comprises a clamping device through which the yarn passes, means for opening and closing the device to grip and release the yarn, a device to draw yarn from a supply and form a first loop in advance of the clamp as the latter grips the yarn, a second loop-forming device on the opposite or delivery side of the clamp and means for actuating the second device to draw yarn from the first loop through the clamp as the latter releases the yarn so as to form a second free loop or slack supply of yarn on the delivery side of the clamping device. Each loop-forming device may be in the form of a bail, and the bails so actuated that after forming their respective loops each will recede leaving a free loop and thus forming a slack supply of yarn on the delivery side of the clamp. Details are given of a form of yarn supply mechanism designed for use with an apparatus for making cemented pile fabric. C.

**Weft Replenishing Loom.** W. W. Triggs (Crompton & Knowles Loom Works). B.P.562,167 of 23/7/1942:21/6/1944. In a weft replenishing loom having a reserve bobbin magazine and a shuttle box adapted to be located in high or low position, the mechanism for effecting transfer from the magazine to a shuttle box includes a normally inactive setting member such as a latch movable to transfer position at a given level relatively to the magazine incidental to an indication of weft exhaustion by the weft detector, and a transfer bunter on the shuttle box movable forwardly toward the latch when it and the shuttle box are in the same high or low position and the latch is in transfer position, to operate the same, but movable forwardly along a path below the latch so as not to operate the same when the transfer mechanism is in high position and the shuttle box is in low position. C.

**Composite Fabric: Weaving.** E. Glendinning and F. Binns. B.P.562,185 of 3/12/1942:21/6/1944. A composite fabric comprises a warp and weft woven cloth formed into a succession of transverse folds (preferably closely spaced or of relatively small pitch to afford one another mutual support) and intersected longitudinally by warps of a ground forming cloth lying substantially in one plane, a weft or wefts of which pass between each or certain of the convolutions of the folds. The amplitude of the fold convolutions may be symmetrical on both sides of the ground cloth or warps or the amplitude of the fold convolutions may be greater on one side than the other of the ground cloths or warps, including the case where the folds are of minimum amplitude and lie substantially in contact with the ground cloth or warps. Groups of folds of substantial amplitude may be separated by folds of smaller amplitude. The folds may be intersected on one or both sides of the plane of intersection by the ground forming cloth by additional warps or woven warps and wefts which may be located in a plane (or planes) at the tops of the folds or loops of the folding cloth or

intermediate the tops and the ground forming cloth. Instead of a single ground forming cloth the composite fabric may comprise a pair of woven ground forming cloths one on each side of the central plane of the composite cloth and intersecting the folds of the folding cloth. Independent weft threads or filling of substantial gauge may be introduced between or within the fold loops. Yarns of animal, vegetable or mineral origin or mixtures thereof may be used. The method of weaving is explained. Padding material comprises superposed layers of the composite fabric secured together by adhesives or by quilting or stitching.

C.

**Weft Replenishing Loom.** W. W. Triggs (Crompton & Knowles Loom Works). B.P.562,193 of 23/7/1942:21/6/1944. A weft replenishing pick and pick weft mixing loom having a gang of two shuttle boxes which shifts in a four-pick cycle is provided with means adapted to move the upper shuttle box to inactive position during the first pair of picks and to move the upper shuttle to active position during the second pair of picks of the same four-pick cycle, a reserve bobbin magazine, an actuator having successive cycles of movements each cycle of which is completed within two successive picks of the loom, a weft detector to indicate exhaustion of weft in the shuttle in the upper shuttle box during the first pair of picks of a four-pick cycle, weft replenishing mechanism actuated under control of the actuator in co-operation with the weft detector, and adapted, when the weft in the shuttle is exhausted, to be actuated to effect replenishment of the shuttle in the upper shuttle box from the magazine during a replenishing operation which is initiated and completed in the first pair of picks of the four-pick cycle, and means adapted to prevent the actuation of the replenishing mechanism during the second pair of picks of the four-pick cycle. The means preventing co-operation between the actuator and the weft detector may comprise means for locking the feeler against action during the second pair of picks, thus enabling the magazine to be used for automatic weft mixing although controlled by a cam which completes its cycle of operations in two picks.

C.

**Straight-bar Heeling Machine.** W. Cotton Ltd., G. Wilders and J. E. Lynam. B.P.562,213 of 19/12/1942:22/6/1944. A straight-bar heeling machine is provided with a needle bar comprising two pairs of parts each consisting of an inner and an outer part equipped with needles, and a pivotal mounting for each outer part wherein the part is movable between a folded running-on position in which it is located at the back (i.e. that side whereat the hooks of the needles are normally presented in a straight-bar knitting machine) of the adjacent inner part with the needles of the two parts in parallel lines, and an extended position in which it is aligned at the outside of the adjacent inner part, and preferably with the needles aligned with those of the inner part. With advantage, locking means are provided for locating the outer parts in the extended position. Such a machine is adapted to knit a heel tab on to one high heel part of one stocking blank by the employment of one of the pairs of parts and to knit another heel tab on to the opposite high heel part of a second stocking blank by the employment of the other pair of parts. Heel tabs are then knitted on the other sides of the blanks.

C.

**Multiple Box Loom Idle Weft Gripper.** Henry Owens & Co. Inc. U.S.P. 2,336,118. The claim is for a set of grippers, each with a fixed and a movable part, which are attached to the ends of the various compartments in a vertical multiple box loom to hold the weft from the idle shuttles against entering the warp shed.

C.

**Loom Picker Lubricating Device.** Crompton & Knowles Loom Works. U.S.P. 2,336,187. The picker spindle has a lubricant bore with lateral outlet connected to the rear outlet in a flared guide carried on the sley. The oil can is held to this flared guide as the sley advances.

C.

**Weft-replenishing Loom Revoked Thread Remover.** Crompton & Knowles Loom Works. U.S.P.2,336,255. The claim is for a thread placer that forms a visible loop in the weft between it and the adjacent selvage of the cloth if the weft replenishment has been revoked through the shuttle being improperly placed.

C.

**Weft-replenishing Loom Pneumatic Thread Removers.** Crompton & Knowles Loom Works. U.S.P.2,336,320/1. The claims are for thread placer mechanism to lift the weft that is due for transfer against the intake mouth of a device into which the weft is sucked by means of an air current.

C.

**Centre Weft Fork Stop Motion.** Draper Corporation. U.S.P.2,336,343. A centre weft fork is actuated by a rod that has a cam for lifting the fork when moved in one direction, a stop to prevent lengthwise movement in the other direction if weft failure occurs, and a guide to prevent rotation of the rod. C.

**Knitting Machine.** Vanity Fair Mills, Inc. U.S.P.2,336,455. The claim is for a knitting machine comprised of slotted needles, guides for placing the thread in the slots, awls, loopers, stationary guides for receiving and directing these various parts, and means for operating them in knitting sequence. C.

**Loom Temple.** Draper Corporation. U.S.P.2,336,591. The bottom part of the temple to which the pod is secured, and the top part above the pod, both end in vertical pieces that lock together by a screw thread device so that the height of the temple top above the pod can be adjusted. C.

**Loom Picking Motion.** Crompton & Knowles Loom Works. U.S.P.2,336,876. A pair of links are connected at the point where they join to the two picking sticks. The two links in each pair are normally at an angle to each other but means operated from the sley tend to bring them into line and thereby impart picking strokes. C.

**Self-threading Shuttle.** Steel Heddle Manufacturing Co. U.S.P.2,336,937. The shuttle is fitted with a threading block, cast as a single piece from hard metal and having a tapered horn extending into the thread channel from one side wall. The horn extends below the level of the axis of the yarn channel, then backwards and inwards. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Wool Scouring Machinery: Future Developments.** W. H. Robinson. *Wool Rec.*, 1944, 65, 930-932. Improvements so far achieved in automatic wool scouring machinery are briefly listed, and future requirements suggested. The factors which prevent the development of the solvent system should be investigated. In the emulsion system, improvements are suggested in automatic feeding, bowl cleaning, rake motions, squeeze rollers and liquor control. W.

##### (D)—MILLING

**Milling and Scouring Flannels and Felts.** D. R. H. Williams. *Wool Rec.*, 1944, 65, 757-759; *Text. Mfr.*, 1944, 70, 266-267. All-wool flannel, 17/18 oz., was treated in the Williams-Peace combined milling and scouring machine. The time taken was 41 min. per piece with 4 pieces in the machine (total time 2 hr. 45 min.) and 180 lb. weight on the trough lid, compared with 1½ hr. for milling and nearly 1½ hr. for scouring and washing-off 2 pieces when each process was done in a separate machine. For the production of commercial felts on the combined machine, reference is made to a previous article (these *Abs.*, 1944, A 294). W.

##### (I)—DYEING

**Cotton Hanks, Braid and Tape: Dyeing.** A. Ellis. *Textile Weekly*, 1944, 34, 26-32. Practical hints are given on the production of level dyeings on cotton yarn in the form of hanks, braid or tape by means of gravity percolation machines of the Rhodes and Simplex types. C.

**Hosiery: Dyeing.** C. H. Asbury. *Amer. Dyes. Rept.*, 1941, 30, 204-205, 210. A discussion of the use of developed, sulphur, naphthol and vat dyes for the dyeing of hosiery, the value and limitations of each type, suitable dyeing procedures and necessary precautions. C.

**Nylon Gloves: Dyeing and Finishing.** J. C. Broadmeadow. *Amer. Dyes. Rept.*, 1941, 30, 193. Knitted nylon gloves combine the advantages of light weight, unusual strength, remarkable elasticity, and the desirable property of returning to the original shape after washing. Some acid dyes can be used for nylon but acetate rayon dyes are preferred. Prior to dyeing, nylon piece goods are first scoured at 140° F. with soap and mild alkali, extracted lightly, tenterd, rolled on a perforated roll, and pre-boarded in a steam chest at a temperature higher than any of the subsequent operations and in the same shape as that desired for the finished product. In dyeing it is necessary to submerge the cloth beneath

the dye liquor at some point to obtain an even dyeing. The dye bath contains the same assistants as are used in scouring. The dye is entered in a warm bath, raised to 140° F. for 20 min., then to 190° F. for 40 min. The bath is cooled to 160° F. for additions. C.

**Silk Hosiery: Dyeing.** *Amer. Dyes. Rept.*, 1941, 30, 211-214. The split bath method of dyeing silk hosiery is studied and the pH range of the entire procedure analysed. The split bath method is claimed to be superior to the single or double bath methods in so far as the quality of finished products is concerned. C.

**Direct Dyes: Alkaline Reduction During Dyeing.** A. Carbone. *Amer. Dyes. Rept.*, 1943, 32, 415-418. In the dyeing of wool and cotton mixture army hose with a mixture of Diamine Fast Blue FFB, Chloramine Yellow and Pyrazol Fast Orange RL the shade increased in redness during dyeing. It was found that the stockings contained residual alkali and since dyeing was carried out in the wetting-out bath, the alkali was present during dyeing. The change in shade could be prevented by adding ammonium sulphate to the dyebath. The original colour change was considered to be due to the presence of alkali and of potential reducing agents such as cellulose and wool. Tests were made of the dyeing of cotton, wool and rayon yarns with Diamine Fast Blue FFB and numerous other dyes, with and without additions of soda ash, ammonium sulphate and sodium chlorite to the dyebath. The results confirm the view that irregularities in dyeing of the type described above are due to alkaline reduction. Direct dyes of the fast-to-light group are particularly sensitive to this type of breakdown. The trouble can be eliminated by controlling the alkalinity of the dyebath and this is best accomplished by the addition of ammonium sulphate. Cotton is less active than viscose rayon and wool in bringing about dye reduction in an alkaline dyebath. C.

**Dyes and Finishing Agents: Substantivity** A. M. Schwartz. *Amer. Dyes. Rept.*, 1944, 33, 164-168. A discussion of substantivity or affinity for cellulose, the mechanism of dyeing, the substantivity of water-soluble direct dyes, water-insoluble dyes and finishing agents, the relationship between the substantivity of dyes and the adhesion of finishing materials to the surface of fibres, and developments in permanent finishes that may be expected as a result of research on synthetic resins and coating materials. C.

**Wool Dyeing: Avoidance and Correction of Faults.** F. Townend. *J. Soc. Dyers & Col.*, 1944, 60, 144-148. The effects are discussed on the dyeing properties of wool of carbonising, peroxide bleaching and sulphur stoving which decrease the affinity (light-dyeing damage), and of setting and anti-shrink processes and damage by alkali, mildew and exposure to light which increase the affinity (heavy-dyeing damage). Methods are suggested for avoiding and correcting uneven dyeing due to improper control of these prior processes, special attention being drawn to the use of hydrogen peroxide in modifying the dyeing affinity of wool. The use of mixtures of chlorinated and normal wool, in which novel effects may be produced by taking advantage of the changed affinity for dyes or of differential shrinkage in milling, is discussed. W.

**Dyeing Worsted Yarn with Chrome Colours.** "Concord." *Text. Merc.*, 1944, 111, 41-42, 67-69. General methods for dyeing by the metachrome and afterchrome processes are given, with detailed suggestions for producing shades in brown, blue, black, green and red. W.

#### (J)—PRINTING

**Printing and Finishing Processes: Modern Trends.** R. W. Jacoby. *Amer. Dyes. Rept.*, 1941, 30, 170-178. Recent developments in printing and finishing processes, including pigment printing, the urea process for the printing of acid and direct dyes on rayon and cotton, conversion printing, and the use of resins for crease-, shrink- and slip-proofing, for improving fastness to washing, and for modifying handle, are discussed. Disadvantages associated with the use of resins, e.g. their effects on the shade and light fastness of certain dyeings, the development of odours, the formation of chloramine on treatment with chlorine in laundering, and the possibility of dermatitis, are pointed out. C.

## (K)—FINISHING

**Cellulosic Fibres: Acid Dyeing and Animalizing.** *Amer. Dyes. Rept.*, 1942, 31, 494, 509-511. The constitution and properties of silk and wool are briefly discussed, and methods of animalizing or basifying cellulosic fibres with the main object of imparting affinity for acid dyes are reviewed. The nature and characteristics of casein, nylon, Vinyon and Rayolanda fibres, and their affinities for the various classes of dyes are discussed. C.

**Nitroparaffins and Derivatives: Use in Textile Processing.** H. Robinette. *Amer. Dyes. Rept.*, 1942, 31, 575-580. A discussion of the physical properties of nitroparaffins and their derivatives, such as nitrohydroxy and aminohydroxy derivatives, soaps, ester-amides, ester-amines, oxazolines, etc., made from the aminohydroxy compounds and fatty acids, amino dioxanes and other products, and their uses as solvents, wetting, scouring, emulsifying, degumming and finishing agents, kier-boiling and mercerising assistants, and as intermediates in the synthesis of various products used in the textile industry. C.

**Cation-active Softening Agents: Analysis.** See Section 5D.

**Glass Cloth Laminated Plastics: Production.** H. W. Collins. *Modern Plastics*, 1944, 21, No. 9, 104-106. Laboratory techniques for the production of small experimental quantities of glass-reinforced, low-pressure laminates are described. The production involves impregnation of the glass cloth with the resin and building-up of the laminates, followed by curing between glass plates under pressure in an electrically-heated oven. Various methods of impregnation are described and curing schedules for laminates impregnated with various resins are outlined. C.

**Glass Fibre for Plastics Reinforcement: Forms, Properties and Handling.** G. Slayter. *Modern Plastics*, 1944, 21, No. 9, 100-103. The forms of fibrous glass chiefly used as reinforcement for low-pressure plastics are continuous filament, all-glass cloths and warps; uni-directional cloths, i.e. cloths with a glass warp and cotton weft; and glass fibre flock. Glass fibres are characterised by high strength, elasticity, stability and resistance to fire, mildew, etc. In the production of glass cloth the fibres are lubricated with a mixture of dextrinised starch, oil, gelatin, neutral emulsifier, complex amine salt and polyvinyl alcohol. To obtain satisfactory adhesion between the resin and the glass fibres, certain of these ingredients must be volatilised and others must be modified but retained on the fibres. The change is best effected by heat treatment which fixes a starch-gelatin film on the fibres, thus providing a firmly anchored base for adhesion with the resin. Methods of heat treatment are briefly described and necessary precautions are pointed out. Methods of applying the glass fibre reinforcement vary according to whether the material is to carry tensile or compressive forces, or both. The different arrangements are outlined. The modulus of elasticity of glass reinforced plastics is affected by condition of cure of the resin, fibre diameter, closeness of weave and direction of fibres, and by the glass-to-resin ratio. C.

**Fabrics: Testing Handle and Effect of Finishing Treatments. Resin-finished Rayon Gabardines: Colour Fastness, and Physical Properties.** See Section 5C.

**Persian Lambskin Pile Fabric: Processing.** S. Wouble. *Text. Col.*, 1944, 66, 95-96. The operations are described of desizing, scouring, batting-up and pile formation, dyeing, and final batting-up and dressing of the pile. W.

**Wool Fabrics: Chemistry and Practice of Finishing.** C. S. Whewell. *Text. Rec.*, 1941, No. 702, 25-27, No. 703, 33-34, No. 704, 29-32, No. 705, 37-41; 1942, No. 706, 26-29, No. 708, 35-37, No. 710, 33-36, No. 713, 35-38; 1943, No. 720, 38-42, No. 722, 43-46, No. 729, 50-52. The theory and practice of the finishing of wool fabrics are described in the light of recent mechanical and chemical developments. These articles deal with the constitution of the wool fibre and its physical and chemical properties, preliminary operations on the woven fabric (weighing, measuring, labelling, perching, knotting, mending and burling), fabric scouring (fundamental principles and theory, manufacture and properties of soaps, synthetic scouring agents, scouring machinery and scouring methods and defects), and factors affecting shrinkage during milling. W.

## (L)—PROOFING

**"Compar" Polyvinyl Alcohol Resin: Characteristics and Uses.** Resistoflex Corporation. *British Plastics*, 1944, 16, 260. A table is given showing the characteristics and the effects of various solvents, gases, and ageing on the transparent, flexible, rubber-like compounded polyvinyl alcohol resin, Compar. It is claimed that this product is 20 times more wear-resistant than natural rubber and the most solvent-proof rubber substitute yet developed. It can be milled like rubber but need not be vulcanized. Various uses are mentioned. C.

**Haydenite Resins: Use in the Production of Raincoats.** Stanley Chemical Co. *Rubber Age*, 1943, 52, 403 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, 830). Haydenites of the thermoplastic resin type are applied to fabric on ordinary rubber spreaders or pyroxylin coating machines which permit the spreading of successive coats under a doctor knife. In general, for fabric coated on one face, the application of 5 or 6 coats of the base coat and one or two of the finish coat will produce the most satisfactory results. A finished dry weight of 2.8-3.2 oz. per sq. yard is recommended. After the first, second or third coat of base coat, a facing calender is applied to the cloth. The air drying material requires no curing operation. Fabrics and garments of extreme lightness and pleasing appearance which meet the requirements of American specifications for service raincoats can be produced. Fabrics coated on both sides have lower tearing strength and resistance to low temperature cracking but provide the possibility of cementing face to back seams without application of cement. The face of the fabric is finished first and the necessary number of coats then applied to the back. In general, two coats with a thin knife, providing approximately 0.75 oz. of dry weight, will be satisfactory. Notes are given on the cementing of seams. C.

**Dihydroxyhexachlorodiphenylmethane: Application in Antiseptic Textile Materials.** R. A. Engel and W. Gump. *Amer. Dyes. Rept.*, 1941, 30, 163-165. An antiseptic is defined as a germ-killing or inhibiting agent intended for use on living tissues, and the agar-plate method of testing antiseptic materials is described. The characteristics required in an antiseptic for application to textile materials are outlined and it is claimed that there is no product available which meets all the requirements. Dihydroxyhexachlorodiphenylmethane fulfils most of the requirements though it is not soluble in acid solution and is removed by laundering and dry cleaning. Agar-plate tests have been made on samples of woollen, silk, cotton and rayon materials treated with this compound alone and in combination with finishing agents, such as synthetic resins and sulphonated tallow, oil, and fatty alcohol. Results of these tests and strength tests are tabulated and discussed. A clear zone of inhibition surrounded all specimens which had been treated with the antiseptic but not the untreated controls. Sulphonated oils depressed the activity of the antiseptic whilst a sulphonated fatty alcohol increased it. For cotton, rayon and silk fabrics treatment with a 0.1 per cent. solution, and in many instances 0.05 per cent. solution, of the agent is sufficient. Woollen goods appear to require 0.1 per cent. or more. This compound has no effect on the tensile strength of the textile materials. C.

**Insulating Tape: Production.** C. C. Downie. *Textile Weekly*, 1944, 34, 22-4. A brief account of the varnishing of unbleached cotton cloth and cutting it into tapes for electrical insulation. C.

**Textile Fibres: Microbiology.** See Section 5A.

**Flame-proofed Cotton Fabric: Deterioration. Mildew-proofed Materials: Analysis for Copper.** See Section 5C.

## PATENTS

**Chlorite and Hypochlorite Bleach Liquor: Application.** Mathieson Alkali Works (New York). B.P. 561,834 of 24/7/1942: 7/6/1944 (Conv. 8/8/1941). Cellulosic textile materials are bleached by treatment with an alkaline solution of sodium or other alkali metal chlorite and a hypochlorite. The ratio of hypochlorite to chlorite is preferably  $1\frac{1}{2}$ :1 based on the available chlorine. The pH of the solution should be between 8.7 and 10.0, and the total available chlorine 1 to 3g. per litre. Oxycellulose formation is less with this process than with the ordinary hypochlorite bleaching, whilst the bleached products are of equal or superior whiteness. C.



**Composite Waterproof Fabric: Production.** R. & J. Pickles. B.P.561,906 of 24/9/1942:9/6/1944. A waterproof sheet material is made by amalgamating, e.g. by calendering together under pressure, a number of sheets of hessian cloth which have previously been prepared by coating with a mixture of plasticised nitrocellulose and linseed and/or castor oil, the proportion by weight of oil being not less than that of nitrocellulose. The coating mixture may also contain fillers and pigments. C.

**Sulphonated Phosphonic Acid Surface-active Agent.** Eastman Kodak Co. U.S.P.2,336,230. The claim is for agents of the formula  $(OH)_2PO \cdot CRR' \cdot O \cdot SO_3H$ , where R and R' are H, alkyl, aryl, naphthenyl or alkaryl. C.

**Window Shade Fabric: Finishing.** E. I. Du Pont de Nemours & Co. U.S.P. 2,336,265. A non-tendering window shade fabric has a coating of cellulose nitrate, a plasticizer and a pigment, at least 20 per cent. of which is zinc oxide having particle dimensions greater than  $0.4\mu$  but less than  $3.2\mu$  in any one direction. C.

**Aeroplane Fabric: Finishing.** E. I. Du Pont de Nemours & Co. U.S.P. 2,336,266/7. (1) A supple, coated fabric having a potential width-way shrinkage of 5-15 per cent. before coating is obtained by thoroughly wetting the fabric with water, allowing it to shrink 5-15 per cent., filling the interstices of the wet fabric with an emulsion of a cellulose derivative in which there is a low proportion of plasticizer and water is the internal phase, drying and stretching to the original width so as to fracture the film minutely, and finally calendering the dry fabric. (2) The cellulose derivative is applied as a composition containing a volatile solvent. C.

**Plastics-coated Cotton Fabric: Printing.** E. I. Du Pont de Nemours & Co. U.S.P.2,336,365. Cotton fabric is coated with a permanent finishing agent selected from alkyl acrylate or methacrylate polymers, alkali-soluble alkyl celluloses, deacetylated chitin, rubber, chlorinated rubbers, polyvinyl alcohols, co-polymers of vinyl chloride and vinyl acetate, and polyamides, and then printed with an alkaline type of paste, to give sharply registered designs. C.

**Cellulosic Fabric Dimension-stabilizing and Dye Affinity-modifying Agent: Application.** Rohm & Haas Co. U.S.P.2,366,340/1. (1) The fabric is impregnated with a solution containing 5-15 per cent. of a compound  $(RO \cdot CH_2 \cdot NR_2 \cdot R_3 \cdot CH_2 \cdot OR_1)_X$ , dried under conditions to secure the desired dimensions, and heated to cause reaction with the cellulose and elimination of nitrogenous compounds; R is an alkyl radical with 2-10 C atoms,  $R_1$  is an alkyl, alicyclic or aralkyl radical with less than 12 C atoms,  $R_2$  and  $R_3$  are alkyl groups with 1-4 C atoms or are united into a ring with the N atom, and X is a salt-forming anion. (2) The above treatment is also claimed as a means to reduce the affinity of cellulose for direct dyes and increase the affinity for cellulose acetate dyes. C.

**Mothproofing Textiles.** D. W. Jayne, Jr. (to Amer. Cyanamid Co.). Canadian P.415,273 of 21/9/1943 (through *Chem. Abs.*, 1944, 38, 1128). The textile is treated with a water-soluble guanidine salt of an aliphatic monocarboxylic acid, and then with a solution of a higher fatty acid salt, to precipitate a water-insoluble guanidine salt. W.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Textile Fibres: Microbiology.** W. S. Marsh. *Amer. Dyes. Rept.*, 1942, 31, 563-569. A report is given of a discussion of bacteria and fungi occurring on textile materials and their effect on the textile materials, the numbers of organisms per sq. in. commonly found on cotton, wool and silk, the use of ultra-violet radiation for the control of air-borne organisms, the treatment of textile materials with germicides and fungicides, and the effects of synthetic resins, formaldehyde, salts of heavy metals, and other compounds on the growth of micro-organisms. C.

**Wool Fibre: Structure; Electron Microscope Study.** C. W. Hock and H. F. McMurdie. *Amer. Dyes. Rept.* 1943, 32, 433-436, 451-454. A more detailed account is given of investigations which have been described elsewhere.



**Measurement of Damage in Wool Materials: Test for Estimating Small Amounts of Mechanical Modification.** C. S. Whewell and H. J. Woods. *J. Soc. Dyers & Col.*, 1944, 60, 148-151. A sample (approx. 0.1 g.) is extracted with alcohol and ether, and agitated for 15 min. at 20° C. in 100 ml. sodium hypochlorite solution (0.12 per cent. chlorine) at pH 10. It is washed for 1 min. in 5 changes of tap water (200 ml. in each case), and then stained with dilute Methylene Blue solution and finally examined under the microscope. Applied to wool samples (A) extracted with alcohol and ether (control), (B) scoured by hand, (C) carded and extracted with alcohol and ether, and (D) carded and scoured with dilute soap solution, the test shows a high degree of sensitivity since it reveals the small amount of mechanical damage which occurs during carding. A further advantage is that judgment is based not upon depth of staining, but upon the area stained. The results appear to be reproducible. It can be used either to obtain an absolute evaluation of the condition of a particular wool, or to estimate the amount of damage caused by processing or treatments. W.

**U.S. Dept. of Agric.: 1943 Wool Shrinkage Studies.** A. Johnston, W. M. Buck and G. C. Le Compte. *Natl. Wool Grower*, 1944, 34, No. 4, 17-20. During 1943, 100 individual clips and a few graded lines were sampled, using the coring machine (these *Abs.*, 1942, A 83). The samples were scoured and their shrinkages checked against those of 10-bag lots scoured by commercial scourers. The differences averaged only 1.115 per cent. Tables are given showing the range of errors for both core and estimated shrinkages. The results show that the core-sampling method for determining shrinkage is more accurate than that based on visual and manual examinations which involve human judgment only. W.

**Australian Merino Wools: Variability of Fibre Fineness.** W. R. Lang. *Pastoral Rev.*, 1944, 54, 138-139. 1,600 samples of Australian merino wool were measured for variability in the thickness of the composite fibres of a single staple. 250 measurements were made on each sample at  $\times 350$  under standard humidity conditions. Curves show the range and standard deviation for 3 wools of 21-22 $\mu$  mean thickness, and the distribution of ranges and standard deviations in various mean thickness groups. W.

#### (B)—YARNS

**"Grex" Yarn Count System: Advantages.** A. G. Scroggie. *Cotton (U.S.)*, 1944, 108, No. 3, 102-103. The author shows by examples the advantages of the "Grex" system in determinations of the weight of yarn in fabrics of stated construction, especially when different fibres are incorporated in the warp or weft. A graph is reproduced of cotton counts from 80 down to 10 and equivalent Grex numbers from 50 up to 550. C.

#### (C)—FABRICS

**Fabrics: Testing Handle and Effect of Finishing Treatments.** E. C. Dreby. *Amer. Dyes. Rept.*, 1942, 31, 497-504. The first part of this paper dealing with the use of the Planoflex friction meter and compression meter for the evaluation of the handle of fabrics has previously been summarised from another source. The second part describes the use of these instruments for determining the effects of finishing agents and processes. Planoflex measurements of cotton poplins treated with different concentrations of each of four softening agents, friction meter measurements on silk hosiery treated with softening agents and with a delustring agent, compression meter measurements on spun rayon twills with and without crease-resistant finishes, and measurements with all three instruments on plain finished and calendered cotton print cloths, cotton sheetings treated with a regular starch finish and a semi-permanent finish, before and after laundering, cotton print cloths conditioned at different atmospheric humidities, and wool-rayon suitings of varied compositions are recorded and discussed. C.

**Flame-proofed Cotton Fabric: Deterioration.** A. S. Tweedie and C. H. Bayley. *Amer. Dyes. Rept.*, 1943, 32, 427-428. Tests were made with a light cotton sheeting which was rinsed in water, dried, soaked for 5 min. in a solution of a flame-proofing agent, centrifuged, and ironed on a flat-bed household press. The flame-proofing agents were (1) borax + boric acid, (2) borax + boric acid + ammonium sulphate, (3) borax + boric acid + ammonium dihydrogen phos-

phate, (4) ammonium sulphate, (5) ammonium dihydrogen phosphate, and (6) ammonium sulphamate. Tables are given showing the changes in tensile strength and cuprammonium fluidity after 5 and 10 treatments, with intermediate washing. All the flame-proofing agents caused measurable losses in strength at the end of ten treatments. Increases in fluidity showed that chemical damage had occurred in all cases. Damage increased in the order 1, 3, 2, 5, 6, 4. C.

**Mildew-proofed Materials: Analysis for Copper.** C. L. Hoffpauir and R. T. O'Connor. *Amer. Dyes. Rept.*, 1942, 31, 395-398. Details are given of procedures for the determination of copper in proofed textile materials by (1) an iodometric titration method, and (2) a spectrophotometric method based on the measurement of the blue colour produced by ammonium hydroxide. Solutions for testing are prepared by digesting samples with concentrated nitric and sulphuric acids. Results are given of determinations by the two methods of copper in copper solutions, cellulose, cellulose to which known amounts of copper solution were added, and cotton osnaburg and burlap treated with copper naphthenate and other copper compounds. Good agreement is shown between the two methods. The volumetric method has proved satisfactory for routine examination of samples of ordinary size containing moderate amounts of copper (3-60 mg. of copper per gram of sample), and is rapid and accurate. The spectrophotometric method gives an excellent check on the volumetric method and is particularly useful when the size of sample is small or the percentage of copper is relatively low (minimum of 0.2 mg. copper). C.

**Resin-finished Rayon Gabardines: Colour Fastness and Physical Properties.** Hazel M. Fletcher, Wilda M. Hay and Andrea J. Surratt. *Amer. Dyes. Rept.*, 1942, 31, 489-493 and 514. Measurements were made of the effects of laundering and dry cleaning five and ten times on the colour, strength, extensibility and dimensions of samples of (A) rayon gabardines with urea-formaldehyde resin and (B) non-resin type finishes. Statistical analyses were made of the fading, breaking load and elongation, and shrinkage data. Results are tabulated and discussed. The (A) fabrics had a firmer handle than (B). Dry cleaning did not greatly affect the appearance of either group. The (A) fabrics became sleazy on laundering and some showed considerable yarn slippage after abrasion. The statistical analysis showed significant differences in colour fastness and physical properties favouring (A) over (B). Fading of (B) fabrics was greater than that of (A), and fading due to laundering was greater than fading due to dry cleaning. There were no significant differences of fading in the colours or in the light and dark shades of (A). In the (B) fabrics the browns and the light shades faded least. (A) gabardines were stronger than (B). Dry cleaning did not affect the breaking strength of either group. Laundering decreased the breaking strength of (B) but not of (A). Resin finishes increased wet breaking strength but not resistance to abrasion. Exposures for 80 hours to light decreased the breaking strength of (B) but not of (A). The extensibility of (B) was greater than that of (A). Neither dry cleaning nor laundering affected the extensibility. The (A) fabrics shrank less than (B). Shrinkage due to laundering was greater than that due to dry cleaning for (B) but not for (A). C.

**Textiles: Informative Labelling.** H. F. Herrmann. *Amer. Dyes. Rept.*, 1941, 30, 194-196, 217. Some scientific aspects of informative labelling are discussed. Retailers have suggested that a simple qualitative description of the article and a plain, honest appraisal of its contents and service properties are required. Some really pertinent data should be given to support the general statements though purely scientific data are more confusing than helpful to the general public. A list is given of types of standards and testing methods which have been established and are in use on a voluntary basis by American mills and merchants for the quality grading of their lines. Meaningless expressions relating to colour fastness are discussed and the need for standard tests is pointed out. Reference is made to legislation regulating the accurate labelling of materials with respect to fibre content and its probable extension to labelling with respect to colour fastness. C.

#### (D)—OTHER MATERIALS

**Cation-active Softening Agents: Analysis.** D. Geltner and W. W. Razim. *Amer. Dyes. Rept.*, 1942, 31, 409-412. Details are given of procedures for the analysis of cation-active softening agents which generally comprise either amido-

amines, imidazolines, oxazolines or amino-esters, neutralised with an appropriate acid. The method involves a preliminary examination, determinations of ash, alcohol extraction, and volatile matter (water, alcohol, organic acid, hydrochloric acid) and the isolation and identification of fatty acids and amines. C.

**Ethylcellulose Films: Properties.** E. E. Halls. *Plastics*, 1944, 8, 57-64 (through *Brit. Chem. Physiol. Abstr.*, 1944, BII, 133). Films of cellulose acetate and of ethylcellulose were exposed to the following ageing tests: immersion in water at room temperature, exposure to dry heat at 60°, and exposure to fluctuating conditions of warmth and dampness; in every case the weight and dimensions of ethylcellulose films changed less than those of cellulose acetate films. Physical and mechanical properties of ethylcellulose are recorded; it is stable under the influence of light and resistant to ageing, being superior to cellulose acetate and much superior to nitrocellulose in these respects. Ethylcellulose allows free passage to light, including ultra-violet light; stability to alkalis permits the use of the usual soaps and detergents for cleansing windows made of this thermoplastic. The chief advantage of ethylcellulose is that it is flexible at -40° C. Its toughness at these low temperatures is unequalled by any other plastic. A wide range of plasticisers are compatible, and ethylcellulose can replace acetate in almost all of the various applications of the latter. C.

**Woolled Sheepskins: Preservation.** R. F. Innes. *J. Int. Soc. Leather Tr. Chem.*, 1944, 28, 78-92. In works experiments sheepskins were stored after sprinkling with (1) common salt, (2) a mixture of common salt and alum, (3) a mixture of common salt and sodium fluoride, and (4) a mixture of common salt and sodium bisulphate (dry pickle), and after immersion in a solution of common salt and sulphuric acid (wet pickle). The dry pickle had the best preservative action over prolonged periods. Laboratory experiments were then made, using both brine and solid salt with a range of disinfectants. Sodium chloride mixtures, containing sodium fluoride, zinc chloride, naphthalene and sodium pentachlorophenate respectively, gave the best results, the extent of preservation being judged by determining the percentage of free fatty acid in the grease extracted from the skin. Further works scale experiments confirmed the good results obtained with mixtures containing zinc chloride or sodium pentachlorophenate. W.

## 7—LAUNDERING AND DRY-CLEANING

### (A)—CLEANING

**Cotton, Rayon, Silk and Wool Fabrics: Effect of Washing.** Florence B. Castonguay, Dorothy O. Leekley and Rachel Edgar. *Amer. Dyes. Rept.*, 1942, 31, 421-426, 439-440. A report is given of a study of the effect of repeated washing (10, 20, 30, 40 and 50 washings) with 0.5 per cent. neutral olive oil soap, silicated soap, or a sulphated alcohol in distilled water on fabrics of cotton, regenerated cellulose rayon, cellulose acetate rayon, silk, wild silk and wool. The fabrics were all analysed for weight, absorption of light, ash, strength and shrinkage; the cellulose acetate rayon was analysed for acetyl and the wool for total sulphur; the silks and wool were analysed for nitrogen and moisture, and the fabrics washed with sulphated alcohol and the wool washed with soap or silicated soap were analysed for sulphate sulphur. The results are given in tables. Large losses in weight of the cotton and wild silk fabrics were due to removal of size. The wool, silk and rayon fabrics increased in weight on washing. The unbleached cotton and regenerated cellulose rayon samples became whiter with silicated soap than with soap. The fabrics washed with sulphated alcohol developed a green tint, which was more pronounced in proteic than in cellulosic fibres and was traced to copper in the distilled water. Residual ash of the cellulosic fibres decreased and that of the proteic fibres increased upon washing with each detergent, the rise being greatest for wild silk and wool washed with silicated soap and least for wool washed with sulphated alcohol. Wet strength of all the fabrics was lowered by washing but only the silk washed with sulphated alcohol and the wild silk lost more than half their wet strength during 50 washings. With the exception of the wool fabric, shrinkage of each fabric with different detergents varied no more than the deviations of the yarns per inch of fabric; comparatively high warp shrinkage of the cotton fabric, weft shrinkage of the regenerated cellulose and silk crêpes, and warp stretch of the silk and wool fabrics were due to relaxation whilst much of the change in area of the

cellulose acetate rayon fabric was caused by its drying in hard creases. The values for the acetyl content of the washed cellulose acetate rayon suggested no change greater than experimental error. Lower and more nearly constant amounts of sulphate were sorbed from the sulphated alcohol by the silk and wild silk than by wool, none was taken up by the cellulosic fibres, and the wool washed with soap or silicated soap did not acquire any sulphate sulphur. The data show that a silicated soap is more destructive to wild silk but no more degrading to cotton, rayon, silk or wool than soap. C.

## 8—BUILDING AND ENGINEERING

### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Cotton: Use in Concrete.** C. R. Platzmann. *Oel u. Kohle*, 1942, 38, 1193-1194 (through *Brit. Chem. Physiol. Abstr.*, 1944, B I, 169). Addition of 2 per cent. of cotton or asbestos fibre to concrete reduces its permeability to water. Plaster of Paris or calcium chloride is used to reduce the setting time of concrete. C.

**Phenolic Laminated Paper Boards: Preparation.** H. L. Cox and K. W. Pepper. *J. Soc. Chem. Ind.*, 1944, 63, 150-154. The preparation of reinforced plastics from paper and phenol-formaldehyde resin is described. The influence of various factors in the preparation of such materials on their mechanical properties is discussed. The resin solution should impregnate the paper thoroughly and uniformly. Close control of the drying process is essential and the impregnated paper should be dried as much as possible consistent with complete bonding during pressing. The optimum resin content is that which just fills the air voids in the paper at any given pressure. This optimum resin content is indicated by a maximum in the curve connecting density and resin content. Means of improving the shear strength parallel to the laminations are discussed. C.

**Lubrication of Valves.** G. H. Pearson. *Industrial Heating Engineer*, 1944, 6, 98-102. Much stiffness and premature wear in valves can be avoided by proper and adequate lubrication. Methods of lubricating several different types of valves and parts are illustrated and described (e.g. parts of screwdown stop valve, parallel slide valve, piston type throttle valve and so on). La.

### (C)—STEAM RAISING AND POWER SUPPLY

**Steam for Power and Process.** H. E. Partridge. *Industrial Heating Engineer*, 1944, 6, 108-111. The balancing of steam and power demands is discussed; examples taken from practice include a laundry, and a carpet factory. The heat balance for the latter is given and illustrated diagrammatically. La.

**Engine Fastenings.** E. Ingham. *Steam Engineer*, 1943, 13, 83-85. Many steam engine breakdowns are caused by the failure of the fastenings such as bolts, cotters and keys, particularly connecting rod, cross-head and piston bolts; cotters in pistons, piston rods, cross-heads air pump-buckets and rods; keys for flywheels. Regular inspection is essential to avoid this trouble and the article discusses the best methods of avoiding premature failure. La.

**Reducing Fuel Consumption.** S. N. Duguid. *Steam Engineer*, 1944, 13, 102-103, 122. Fuel economy is briefly considered under the following headings: lagging, eliminating air and water films, avoid unnecessary boiling, space heating, steam engines, general comments. La.

**Mechanism of Steam Formation.** W. Goldstern. *Steam Engineer*, 1944, 13, 108-110, 115. A theoretical consideration of the quantities of heat involved in steam formation by heating hot water and reducing the pressure on hot water. La.

**Entropy and the Steam Cycle.** "Vacuum." *Steam Engineer*, 1944, 13, 116-119, 149-152, 160. Carnots cycle is briefly considered and is then compared with the Rankine (saturated steam) cycle, the approach being mainly historical. Subsequently practical applications to efficiency calculations are discussed and the progress in thermal efficiencies of a number of power stations is examined. La.

**Planning Steam Generation.** F. D. Mosher. *Laundry Age*, 1944, May 1, 57-62. An article discussing the planning of efficient steam generating plant for post-war use. Mechanical stokers and automatic control have rendered hand-firing obsolete and full advantage should be taken of their superiority over the older methods. La.

**Boiler Feed Water Regulation.** H. Hillier. *Mech. World*, 1944, 116, 76-80. A long abstract of a paper read before the Institute of Marine Engineers in which boiler and feed system characteristics are discussed in relation to boiler feed water regulation. Boilers are divided into two types, namely, tank boilers (including Scotch, Cornish, Lancashire, Economic, etc.) and water tube boilers and the feed and pressure characteristics are illustrated by a diagram. Types of feed pump and their controls are analysed in tabular form and discharge pressure, capacity characteristics of several types are described and illustrated graphically. La.

**Vertical Boilers.** E. Ingham. *Dyer*, 1944, 92, 41-43. Advantages and types of vertical boiler are first described briefly and then defects, and their prevention and remedies are considered. The points covered include external corrosion, removal of ashes, leaks, etc. La.

**Boiler Efficiency.** C. F. Wade. *Industrial Heating Engineer*, 1944, 6, 31-33. A general consideration of boiler combustion efficiency, separating the chemical and physical conditions. General furnace conditions and flue gas analysis are discussed. La.

**Heat Transmission in Economisers.** W. Goldstern. *Industrial Heating Engineer*, 1944, 6, 57-60, 85-87. An economiser is installed in order to reduce the flue gas temperature and at the same time increase the feed-water temperature. The best method for comparing economisers is worked out and typical heat transmission curves are illustrated. La.

**Electrode Boilers.** *Industrial Heating Engineer*, 1944, 6, 93. A description of a modern installation of Bastian and Allen electrode boilers for factory heating and canteen requirements. 3-350 kw. units each evaporating 1,000 lb./hr. at 120 p.s.i. are installed, as well as an electrode water heater. La.

**Use of Flash Steam.** W. Broadbridge. *Power Ldy.*, 1944, 71, 93. An account of the flash tank installed in the Wardle dryer at the Watford Steam Laundry. La.

#### (D)—POWER TRANSMISSION

**Plastics Bearing Materials: Bearing Strength.** R. T. Schwartz and E. Dugger, Jr. *Modern Plastics*, 1944, 21, No. 9, 133-137, 180-184. For the determination of bearing strengths, the test specimen, which was 0.938 in. wide and  $\frac{1}{8}$  in. thick, and had a 0.250-in. diameter bearing hole and an edge distance of 2.5 times the diameter, was used as the centre plate in a 3-plate jig employing hardened steel pins to provide the bearing load, the jig being loaded in tension. Deformation was measured between points on a line with the loaded edge of the hole and points in the jig. Simultaneous readings of load and deformation were taken until 4 per cent. deformation of the hole diameter was reached, at which point the strain gauges were removed and the specimen loaded to failure. The loads were converted to bearing stresses by dividing them by the bearing area, i.e., the diameter of the hole times the thickness of the specimen. Bearing stress at which the bearing hole was deformed 4 per cent. of its diameter was determined from the curve of bearing stress plotted against deformation; ultimate bearing stress was calculated from the maximum load sustained by the specimen. Results are given for various plastic materials. The bearing strengths of the thermoplastic materials tested were considerably lower than those of the laminated thermosetting materials. A high-strength paper phenolic laminate had the highest bearing strength of all the materials tested. Bearing strength at 4 per cent. deformation of the hole diameter ranged from 4,000 lb. per sq. in. for a cellulose acetate butyrate material to 31,100 lb. per sq. in. for the paper phenolic laminate. No specific correlation was found between bearing strength and tensile or compressive strength. The failures at the ultimate bearing stresses for all specimens except compressed phenolic-resin-impregnated laminated maple were in tension across the hole. The specimens of the latter material failed in transverse tension by splitting lengthwise through the hole. The effects of hole diameter, edge distance and thickness, and the use of the bearing test data in design are discussed. C.

#### (F)—LIGHTING

**Bleaching, Dyeing, Printing and Finishing Mills: Lighting.** J. W. Howell. *Trans. Illum. Eng. Soc. (London)*, 1943, 8, 153-170. Flow charts for finishing sections of the cotton and woollen industries are given, and the individual pro-

cesses and their lighting requirements are discussed. In the cotton industry, illumination in the range 10-15 ft. c. is required for inspection (soft warehouse), hank, warp or piece printing, colour mixing, schreiner, yarn polishing, and cropping. Dye inspection, printing, and final inspection require 15-20 ft. c. For etching and engraving, burling and mending processes 25-50 ft. c. are required and over 50 ft. c. for perching. General requirements and suitable types of lighting for the various rooms and departments are indicated. C.

**Light and Vision.** Sir John Parsons. *Trans. Illum. Eng. Soc.* (London), 1943, 8, 99-109. A report of an address. The response of the eye to light, illumination and visual acuity, the influence of background, tests of glare, the colour of light, vision at low illuminations, vision and illuminating engineering, and the I.E.S. code are discussed. Reference is made to the aims and work of the Illuminating Engineering Society, and various problems requiring further investigation are mentioned. C.

**Low Pressure Fluorescent Lamps: Applications.** W. R. Stevens. *Trans. Illum. Eng. Soc.* (London), 1943, 8, 175-195. Diffusing reflector, specular reflector, spread reflector, prismatic and diffusing glass, and plastic fittings for 5 ft. fluorescent lamps, and fittings employing louvres, are discussed. The results of experimental studies of the effects on light output of variations in size and shape of diffusion trough fittings for single and multilamp systems are briefly considered. Colour characteristics and radiant heating and stroboscopic effects are discussed and their influence on installation design and on the suitability of the lamps for various purposes is indicated. A method of calculating the number of lamps required to produce a given illumination intensity is explained. Present applications of 5 ft. fluorescent lamps in offices, factories and workshops are described, possible future applications are mentioned, and the probable influence of fluorescent lighting on building design is briefly discussed. C.

**Windows: Area Calculations.** T. Smith. *Trans. Inst. Illum. Eng. Soc.* (London), 1943, 8, 110-118. Simple equations are given for the determination of the window area necessary to secure a given penetration of daylight into a room and for the determination of daylight contours. Evidence is presented to show that the results to which these equations lead are of good accuracy. The mathematical theory on which the equations are based is briefly explained. C.

**Windows: Sky Factor Value.** P. J. Waldram. *Trans. Illum. Eng. Soc.* (London), 1944, 9, 16-21. Methods of determining the sky factor value of windows are critically discussed. The advantages of graphs over tabulated data are pointed out. The setting out of sky factor contour plans is described and the effects of obstructions are considered. C.

#### (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Air-conditioning Plant: Reduction of Noise.** A. J. King. *Engineering*, 1944, 157, 501-504. The various causes of noise from air-conditioning plant employing electric fans are analysed, the measurement of noise by means of instruments is explained, and measures for noise reduction are described. C.

**Dew-Point Hygrometer: Manipulation.** J. A. Van den Akker and W. A. Wink. *Science*, 1943, 97, 494. Condensation of water on the polished metal surface of dew-point apparatus can be more easily detected if a thin film of a wetting agent is applied to the surface, leaving, for example, a rectangular central region untouched by the agent, and all the film excepting an invisible layer is removed by rubbing with a clean cloth. Condensation of water upon the zone treated with the wetting agent immediately forms an invisible continuous film, whilst the condensation upon the central zone occurs in the usual manner. Because of the exceedingly narrow line of demarcation between the two zones, a difference in reflectance of the order of 1.5 per cent. can be observed by an experienced operator. C.

**Ventilation.** S. Smith. *Industrial Heating Engineer*, 1944, 6, 73-75. Some notes, by permission of the I.H.V.E., on air distribution, ventilation and unit heating. La.

#### (I)—WASTE DISPOSAL

**Trade Waste Waters: Treatment at Traders' Premises.** W. Scott and W. Foster. *Inst. Sewage Purification, J. and Proc.*, 1942, 186-195. A description

of experimental work in treating waste waters from felt manufacturing (re-organisation of an existing purification plant dealing with acid waste), tar distilling, mercerising, dyeing and finishing (reconstruction of an existing plant, including automatic pH recording and control of chemicals), and dyeing and milling of berets. W.

**Lanolin-resin Protective.** Ministry of Aircraft Production. D.T.D. 663, March, 1944. The specification covers a homogeneous solution of lanolin (D.T.D. 122B) and resin (D.T.D. 375C) in a mixture of pool spirit S.B.P. 3 and xylene (Brit. Standard Specification 458), with an approved oil-soluble dye. Particulars are given of the distillation range of the pool spirit, and of the method of determining the hardness of the material. It is suitable for application by brushing, dipping or spraying. W.

#### PATENT

**Dehumidifying Apparatus.** John B. Pierce Foundation. U.S.P. 2,336,456. The illustration shows a tube of hygroscopic, pervious material surrounded by a wider jacket, both provided with air inlet tubes at one end and exit tubes at the other. A gas burner is lit at the inlet to the pervious tube. This tube is also surrounded by a cooling coil to remove the latent heat of condensation. C.

### 9—PURE SCIENCE

**Fuel Gas Water Vapour: Determination.** R. J. Pfister and D. J. Kerley. *A.S.T.M. Bull.*, 1944, No. 127, 17-22. A technique is described for determining moisture in fuel gases, by means of the Evelyn photo-electric colorimeter. The analysis requires a sample of condensate frozen out at  $-70^{\circ}\text{C}$ . from a measured volume of gas. Enough gas is sampled to yield about 0.25 gm. of water. The amount of any non-aqueous diluent present in the sample is given by the difference between the weight of the condensate, after warming and venting to the atmosphere, and its approximate water content. To the condensate 25 ml. of the water indicator solution (0.1 per cent. cobaltous bromide in butanol) are added and the transmission is read in the Evelyn colorimeter at  $74.0^{\circ}\text{F}$ ., with the 660  $\text{m}\mu$  band filter. Three calibration graphs are used to correct, if necessary, the transmission of the indicator solution (1) for a slight deviation in temperature from the standard, (2) for non-aqueous condensate as indicated by the total weight of condensate, and (3) to convert the corrected transmission to water content of the gas sampled. Results from both field and laboratory tests indicate that water contents may be determined to within  $\pm 3$  per cent. of the absolute value of the moisture present. C.

**Soluble Phosphate and Silica: Determination in Water.** T. S. Harrison and H. Storr. *J. Soc. Chem. Ind.*, 1944, 63, 154-157. Controlled reductions of phosphomolybdate and silicomolybdate by quinol to molybdenum blue are used for the determination of phosphate and silica, each in the absence of the other, in water. Details of the procedures are given. Measurements on the blue solutions are made with the Spekker photo-electric absorptiometer. Conditions suitable for the determination of either radical in the presence of the other can be produced by adjusting the acid concentration. Some typical results are given and it is shown that very little interference is caused by the presence of various other ions in the water. Results obtained in 30 min. (or less) on a maximum sample of 40 ml. compare favourably with those given by the much longer gravimetric processes, which require large samples. A short absorptiometric study of the course of the phosphate reaction and the changes occurring when the order of the added reagents is varied is reported. C.

**Glutamic Acid: Determination in Proteins.** H. S. Olcott. *J. Biol. Chem.*, 1944, 153, 71-82. A method for the determination of glutamic acid in proteins is based on the measurement of the loss in amino nitrogen occasioned by the transformation of glutamic acid to pyrrolidonecarboxylic acid at  $125^{\circ}$  and pH 3.3. The glutamic acid is approximately 92 per cent. converted in 4 hours. Cystine interferes but when a suitable correction is applied the method can be used to estimate the amount of glutamic acid in protein hydrolysates. By the use of the Van Slyke manometric apparatus, the method is applicable to the determination of glutamic acid in 25 to 100 mg. samples of protein with an estimated accuracy of 5 per cent. Results obtained for egg albumin, zein, cottonseed



globulin, casein, gelatin, wool and feather keratins and various other proteins are compared with those of previous determinations by other methods. C.

**Oxygen: Determination in Organic Compounds.** P. J. Elving and W. B. Ligett. *Chemical Reviews*, 1944, **34**, 129-156. A critical review of methods for the determination of oxygen in organic compounds including methods based on complete oxidation, destructive chlorination, and reduction. C.

**Gluten Sulphydryl Compounds: Oxidation.** J. C. Baker, H. K. Parker and M. D. Mize. *Cereal Chemistry*, 1944, **21**, 97-107. With refined flours of widely varied strength, the SH values per gram protein ranged from 0.73 to 1.22 mg. for aqueous extracts; from 0.12 to 0.22 mg. for hand-washed glutens; and from 0.05 to 0.13 mg. for purified glutens. No consistent relationship was found between the SH content of the three flour fractions of various flours or between their SH content and gluten strength. A large fraction of the SH in the glutens could not be removed by repeated washings. Since added glutathione may be readily washed out, a considerable proportion of the sulphydryl groups of flour is apparently present in more complex cysteine combinations. These sulphydryl compounds do not appear to be an integral part of the molecular structure of the gluten proteins, since the SH content of the purified glutens varied widely. Treatment of flour with chlorine and nitrogen trichloride, mixing doughs in oxygen or with sodium chlorite, fermenting doughs with or without bromate, and natural ageing of flour lowered the SH content of water extracts and glutens prepared therefrom. The total decrease in SH which resulted from the flour treatments was equivalent to approximately 100 p.p.m. glutathione, a quantity which is sufficient to produce marked effects in bread making. Changes in gluten strength did not parallel the reductions in SH content due to oxidation. C.

**Hydrogen Bond: Importance in Textile Chemistry.** C. F. Goldthwait. *Amer. Dyes. Rept.*, 1941, **30**, 166-168. A general account is given of the part played by hydrogen bonds in the structure of cellulose and protein fibres, the formation of starch granules, the aggregation of direct dyes in solution, and the dyeing of cotton, wool, and nylon. The origin and rise of the hydrogen bond theory is briefly discussed. C.

**Cross-linked Polymers: Molecular Size Distribution and Gel Point.** W. H. Stockmayer. *J. Chem. Phys.*, 1944, **12**, 125-131. A statistical calculation of the gel point and of the molecular size distribution is made for cross-linked high polymers of arbitrary initial size distribution. The weight-average polymerization degree of the cross-linked polymer depends only on the weight-average polymerization degree of the initial polymer and the degree of cross linking. The results obtained also apply to certain vinyl-divinyl copolymers. Polymerization degrees can be estimated from observations of the gel point. C.

**Varnishes and Film-forming Solutions: Air Content and Degassing.** E. Manegold and F. Peters. *Kolloid Z.*, 1942, **101**, 1 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, 162). The liquid to be investigated was saturated with dry air at 20° and at a total pressure of 760 mm. Hg. A measured amount was placed in an apparatus evacuated to about 0.005 mm. Hg and the solvent was distilled into two liquid air-cooled traps. The air expanded in the evacuated apparatus, after removal of the last traces of solvent vapour by freezing, was collected in a burette by means of a Sprengel pump and its volume at 25° C. and 760 mm. Hg was read. Tables are given showing solids in weight per cent., specific weight of liquid, volume of gas dissolved in 100 c.c. liquid, partial pressure of air over liquid, and Bunsen absorption coefficient for various non-pigmented clear varnishes, pigmented varnishes, and nitrocellulose and cellulose acetate solutions. For degassing with ultrasonic waves the vessel containing the liquid was placed in a sound-conducting liquid of a quartz ultrasonic generator (350 kc, 180 watts), consisting of paraffin oil 5 cm. deep for 5 min. The volume of air freed was measured at 25° C. and 750 mm. Results for some of the varnishes and solutions are tabulated. C.

**Emulsions: Film Formation.** H. Wagner and A. W. Böhnisch. *Kolloid Z.*, 1942, **100**, 263 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, 162). A report is given of observations of the formation of films by oil-in-water and water-in-oil emulsions of linseed oil, chlorinated rubber, Bunalit, Acronal II, Plexigum KP, Mowilith N, and polystyrene. Testing of the optical properties, microscopic examination at a magnification of 100 in transmitted,



incident, and mixed light, and solubility tests in water and in benzene were performed on films obtained by spreading the emulsions on glass. A reversibility test was carried out on films on glass. Films produced on a zinc plate were tested for permeability to water by the cadmium test (1936). Thick films for cross-sectional examination by opaque illumination were obtained by repeated brushing of the emulsions on pasteboard primed with nitrocellulose varnish. For investigation of the absorption of the individual phases by the background the emulsions were spread on gypsum, on untreated pasteboard and on pine. Tables are given showing the characteristics of the various films. An attempt was made to classify the films according to the Manegold gel system. There are lamellar and fibrillar systems, as well as various mixtures of the two. Under special conditions corpuscular systems also occur. The lamellar system is the most suitable one. C.

**Plastics: Water Absorption; Determination by Beam Deflection.** J. Delmonte and L. Asselin. *Modern Plastics*, 1944, 21, No. 9, 138 and 188. Samples are cut to lengths of 5 or 6 in. and thicknesses of about  $\frac{1}{8}$  in. and coated along one side. The cut edges are then covered with a thin moisture-impervious film of metal, 1 mil thick, which is held in place by a thin adhesive coating not chemically reactive with the plastic. The entry of moisture is thus limited to one side. The specimen is supported as a cantilever and immersed in water, and the movement of the end of the beam is measured. Deflection/time curves are given for samples of various plastics of different thicknesses. Log deflection/log time plots for polymethyl methacrylate and cast phenolic plastics give straight lines, which for a given material are of constant slope but differ in position according to the thickness of the specimen. C.

**Polymer Films: Electrical Current Accompanying Diffusion of Water.** C. Fischer and F. H. Muller. *Kolloid Z.*, 1942, 101, 43 (through Mark & Proskauer's *Resins, Rubbers, Plastics Abstr.*, 1943, 161). The diffusion of water in high polymers gives rise to an electric current which can be measured on a sensitive electrometer. The underpart of the frame holding the film is connected with an efficient vacuum pump (0.1 mm. Hg) which removes the diffused water vapour. The charge carried along with the water is taken up on the underside of the film by a copper gauze held in contact with the film and led to a Hoffmann electrometer with a maximum sensitivity of  $1.6 \cdot 10^{-16}$  coulomb. All other parts of the apparatus are grounded. Results for polystyrene, cellulose triacetate and polyvinyl chloride films are shown graphically. The maximum value reached by this electrical phenomenon is higher for the material with larger permeability. The smaller the permeability, the longer is the time required to attain a steady state in the diffusion. The rise of the electric current is slower the longer the time required to reach a steady state. The velocity of the appearance of this space charge must be a function of the electrical conductance of the material on the assumption that the temporary loss is accompanied by a compensating space charge in the film. C.

**High Polymer Solutions: Light Scattering.** P. M. Doty, B. H. Zimm and H. Mark. *J. Chem. Phys.*, 1944, 12, 144-145. An equation for the turbidity of a colourless binary mixture due to fluctuations in density and concentration is discussed and modified. Some preliminary measurements of the turbidity of polystyrene fractions of known osmotic molecular weight in two solvents are shown to give an expected linear relationship and the molecular weights determined from the turbidity measurements are compared with the osmotic molecular weights. C.

**Soap Solutions: Absorption of Light.** M. E. L. McBain. *J. Phys. Chem.*, 1944, 48, 89-95. Sodium oleate solutions absorb light between wave lengths of 3022 and 2594 Å. Photographic plates obtained with the mercury arc and the hydrogen-discharge tube and sodium oleate solutions of different concentrations, and graphs of the relative density of the hydrogen absorption along the  $\lambda_{2967}$  line for different concentrations of sodium oleate, show that the absorption of light may vary periodically in one series of concentrations, and irregularly in a duplicate series. Measurements of light scattering and the results of experiments in which a soap solution was placed in a small cube and the absorption measured with the cube in different positions indicated that the failure of soap solutions to obey Beer's law is due to orientation of the colloidal particles or lamellar

micelles, each solution showing different arrangements of aggregates. Other scattered observations have shown that the absorption of light by some molecules depends upon the direction in which the light passes through them. C.

**Sugars: Spectrofluorescence.** S. Judd Lewis. *J. Soc. Chem. Ind.*, 1944, 63, 157-160. When a fluorescent substance is illuminated by a spectrum, the curve of the intensity of the degraded light at successive wave lengths is an expression of the chemical nature of the substance. Suitable apparatus and technique for the study of sugars by this method are described and curves obtained for glucose, fructose, sucrose and lactose, and for mannitol medicated with glucose and with sucrose, glucose medicated with mannitol and with fructose, and sucrose medicated with mannitol and with raffinose are presented and discussed. By means of such curves it is possible to differentiate between the different sugars and also between a pure sugar and the same sugar containing a very small proportion of another sugar. The method may be applied to solids or solutions. C.

**Colour-match Filters for Tungsten Filament with Sodium Vapour Lamps.** H. G. W. Harding. *Trans. Illum. Eng. Soc.* (London), 1944, 9, 89-92. To determine the luminous intensity of a sodium vapour lamp by means of a visual photometer the radiation from the sodium lamp is generally compared with the filtered radiation from a tungsten filament lamp. A filter made from Chance OB<sub>2</sub> and OY<sub>1</sub> glasses enables the measurements to be made under colour-match and approximately energy-match conditions. Details of the construction and properties of this filter are given, and its performance is compared with that of a Zeiss glass filter. The spread in the results of six observers is about 2½ per cent. with the Chance glass filter and about 7 per cent with the Zeiss glass filter. The mean values of the readings obtained with each of the filters agree to about 2 per cent. Other filters which may be suitable for this purpose are Corning 978 with Chance OY<sub>1</sub> glasses or the combination of Wratten 23B and Wratten 57 gelatin filters. C.

**Photo-electric Photometers: Properties, Use and Maintenance.** J. S. Preston. *Trans. Illum. Eng. Soc.* (London), 1943, 8, 121-152. Problems arising in the application of emission photocells and selenium rectifier photocells to photometry are examined. The difficulties of securing a close approximation to a linear scale and to the spectral sensitivity of the standard eye, the life, stability and fatigue of photocells, temperature co-efficient, dark current, non-uniformity over the area of the sensitive surface, stray radiation, and the use of photo-electric instruments for measuring fluctuating light sources are considered. The response of the rectifier cell to oblique illumination and the size of cell best suited to any given purpose are also discussed. A number of colour correction filters proposed for use with both types of photo-cell are cited. The principles and methods of use of standard types of photometer circuits are described and critically discussed. The circuits included are the direct-reading and the integrating circuits for emission cells, and the light-meter, Campbell-Freeth, and balanced-cell circuits for rectified cells. As an example of a complete instrument, a new portable emission-cell photometer is described in which the amplifier circuit, comprising two stages of D.C. amplification, includes an electrometer tetrode, and gives a current gain of  $2 \times 10^7$  with stability adequate for measuring photocurrents down to  $2 \times 10^{-14}$  amp. to within  $\pm 5$  per cent. C.

**Portable Decade Photometer.** J. L. Nickerson. *Rev. Sci. Instruments*, 1944, 15, 69-72. Details are given of an instrument designed to meet the requirements of a practical field method for determining blood volume with the dye T-1824. In this instrument a beam passing through a cell filled with the dye-laden serum sample is compared with a similar beam which passes through a cell containing clear control serum and through filters. The matching field, instead of being continuously variable, is changed in a series of discrete and suitably related steps. This is achieved by the use of a series of coloured plastic filters which are arranged in two groups, one comprising the optical densities in the hundredths from 0.00 to 0.09 and the other the optical densities in tenths from 0.30 to 1.70. Combinations of these filters in pairs, one filter from each group, make it possible to determine optical densities from 0.30 to 1.79 in steps of 0.01, which is within the limit of intensity discrimination over most of the range. The development of the instrument is described and its advantages are pointed out. C.

**Tests with B.T.B. and B.K.B. Blowfly Dressings.** D. F. Waterhouse. *Australia: J. Council Sci. Ind. Res.*, 1942, 17, 1-15. Laboratory and field tests showed the superiority over other dressings of B.T.B. (boric acid-tar oil-bentonite) dressing. Since the recommended tar oil is not available owing to the war, other tar oils, mineral (petroleum) oils, mixtures of tar oils and mineral oils, eucalyptus and other essential oils, and mixtures containing carbon tetrachloride and ortho-dichlorobenzene were considered as substitutes, and tested for stability, powers of penetration, irritation and effect on contact toxicity. The best results were given by a mixture of ortho-dichlorobenzene, lysol and kerosene, and 20 per cent. of this was incorporated in a new dressing, B.K.B., the other constituents being boric acid (15 per cent.), bentonite (3 per cent.), Agral 2 (wetting agent), (0.5 per cent.) and water (61.5 per cent.). Tests with a number of bentonites showed the superiority of processed American clays over all other samples. W.

**Sheep Blowfly Research. (I) Survey of Maggot Collections from Live Sheep and a Note on the Trapping of Blowflies.** G. A. Hepburn. *Onderstepoort J.*, 1943, 18, 13-18. The distribution and relative importance of sheep blowflies in the Union of South Africa are surveyed. *Lucilia cuprina* is responsible for 55 per cent. of the total strikes. Trapping records at Onderstepoort are analysed, these showing the seasonal abundance of the flies. The necessity for using selective baits is stressed. W.

**Sheep Blowfly Research. (II) Suint Investigations.** M. C. A. Nolte. *Onderstepoort J.*, 1943, 18, 19-25. The possible correlation between suint composition and blowfly strike was investigated by studying the inorganic acids in the fleece. Raw wool was extracted by a modification of Rossouw's method (these *Abs.*, 1938, A 694). The following methods of isolating the organic acids were investigated: (1) the addition of ammonium sulphate to an ethyl alcoholic solution of the acids liberated from the acidified suint (Rimington and Stewart, these *Abs.*, 1932, A 352); (2) the addition of potassium carbonate to an ethyl alcoholic solution of the potassium salts of the organic acids (Lassar-Cohn, *Arbeitsmethoden f. organisch-chemische Laboratorien*, 1923); (3) extraction of the acidified suint by means of solvents, e.g. ethyl ether; (4) steam distillation of acidified suint to recover the volatile acids. Benzoic acid was identified as a decomposition product of hippuric acid, but a satisfactory separation of the organic acids present in small quantities was not achieved. Suint preparations and extracts, e.g. acid fractions, failed to attract blowflies. No correlation between suint composition and blowfly strike was demonstrated. W.

**Sheep Blowfly Research. (III) Olfactory Reactions of Blowflies.** G. A. Hepburn and M. C. A. Nolte. *Onderstepoort J.*, 1943, 18, 27-48. W.

**Sheep Blowfly Research. (IV) Field Tests with Chemically-treated Carcasses.** G. A. Hepburn and M. C. A. Nolte. *Onderstepoort J.*, 1943, 18, 49-57. W.

**Sheep Blowfly Research. (V) Carcasses as Sources of Blowflies.** G. A. Hepburn. *Onderstepoort J.*, 1943, 18, 59-72. W.

**Sheep Blowfly Research. (VI) Treatment of Myiasis.** H. O. Mönnig. *Onderstepoort J.*, 1943, 18, 75-84. The properties of an ideal dressing for the treatment of blowfly strike are enumerated and discussed. A dressing which has given good results in field tests consists of 43 per cent. alcohol (96 per cent.), 43 per cent. creosote oil (b.p. 200-240°C.), 11.25 per cent. liquid paraffin, 2.5 per cent. cresol and 0.25 per cent. sulphuric acid. An addendum states that, owing to insufficient supplies of oil, the dressing has been altered, and now has the following composition: 40 per cent. alcohol (96 per cent.), 5 per cent. second grade motor oil, 10 per cent. light fuel oil, 2.5 per cent. cresol, 0.15 per cent. sulphuric acid, 21.175 per cent. benzol and 21.175 per cent. neutral creosote oil. The efficacy of the mixture is as high as before. The effects on the various ingredients on the sheep's skin are discussed. Such mixtures are irritant to the healthy skin of most sheep, those with a relatively dry fleece being less affected than those with much yolk. W.

#### PATENT

**Bacterially-decutinized Cotton Fibre: Production.** Chemical Foundation, Inc. U.S.P.2,336,252. The claim is for a new product that readily disperses in cellulose solvents, obtained by subjecting cotton to the action of aerobic cellulose-

decomposing bacteria long enough to remove the cuticle without much destruction of the cellulose. C.

## 10—ECONOMICS

**Belgian Textile Industry: Output 1937.** Belgian Information Office. *Textile Weekly*, 1944, 34, 58, 60. Extracts from the "Belgian Handbook" show the number of operatives in various textile branches in 1937. There were 150,277 altogether, including 40,730 in cotton spinning and weaving. There were about 2 million cotton spindles and 55,000 looms. C.

**Indian Cotton Industry: Output 1942-43.** Indian Cotton Committee. *Textile Weekly*, 1944, 33, 982-4. Exports of Indian cotton for the seasons 1939 to 1943, the proportions of staple lengths above and below  $\frac{3}{8}$ -inch, and the consumption of Indian cotton by Indian mills are tabulated and discussed. Raw cotton exports have fallen from more than 3 million bales in normal years to about 150,000 bales (392 lb.) in 1943. Cloth exports have increased from about 250 million yds. to 900 million but are to be controlled at 600 million. The proportion of long and medium staples received at Indian mills has risen to 68 per cent. The quantity of mill-made cloth available for consumption in India was about 4,422 million yds. in 1937-38, but only 3,208 million yds. in 1943. Handloom production is believed to have fallen by a similar amount but Government requirements increased by about 1,000 million yds. C.

**United States Textile Exports.** United States Department of Commerce. *Textile Weekly*, 1944, 34, 74-76. Statistics of textile exports by the United States are tabulated under 31 headings for 1906, 1913, 1919 and each year from 1920 to 1939. C.

**Battle of the Fibres.** *Wool Rec.*, 1944, 65, 890-895. Quotation from an article in a recent issue of the *New England Letter* of the First National bank of Boston. W.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Air-borne Infection: Control.** O. H. Robertson. *Science*, 1943, 97, 495-502. A survey is made of evidence for aerial transmission of infection and measures are reviewed for the control of air-borne infection, including (1) means designed to prevent dispersal of infectious material into the air, e.g. isolation, masking and dust control, and (2) measures for reducing the infectivity of contaminated atmospheres, e.g. ventilation, ultra-violet irradiation, and chemical air sterilisation. Promising results obtained with ultra-violet radiation are reported and limitations of this method of sterilisation are pointed out. Studies of the air-sterilizing effects of sodium hypochlorite, various aerosols, and propylene glycol are discussed and it is pointed out that the question of the possible toxic effects from breathing atmospheres containing chemical compounds can be answered only by long-term observations on appropriate animals. C.

**Virginia Mills Institute of Textile Technology: Establishment.** *Science*, 1944, 99, 342. An Institute of Textile Technology has been established in Charlottesville, Va., by trustees representing 28 textile mills in the East (U.S.A.). Its purpose is to maintain an educational institution and to promote scientific research and processes related to the textile industry. The charter provides that none of its profits shall go to any member or individual and expressly prohibits its use of propaganda designed to influence legislation. C.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL

**Sheep Husbandry in India.** R. L. Kaura. *Indian Vet. J.*, 1943, 19, 307-318.

**Genetics of the Wensleydale Breed of Sheep. III. Arithmetical Aspects of Selection.** F. W. Dry. *J. Genetics*, 1943, 45, 265-268. This paper discusses (1) numerical aspects of selection for a simple heterozygote, and (2) selection for a fancy point (blue complexion) as considered from the livestock breeding angle, with progeny testing kept in mind. W.

**Merino Sheep: Density and Development.** R. Wagner. *Merino Breeders' J.*, 1944, 6, No. 2, 11-14. A certain amount of development is necessary to maintain the standard of merino sheep. The relationship of fibre density to development is discussed in connection with practical methods of judging density. W.

**South African Merino: Future.** J. R. Bührmann. *Merino Breeders' J.*, 1944, 6, No. 2, 15-16. The pure merino is no longer an economic proposition in South Africa. The new ideal is the plain-bodied merino which can compete as a producer of both wool and mutton. In developing this type, South Africa must no longer be guided by Australian ideals. W.

**Merino Sheep: Development.** A. G. L. Murray. *Merino Breeders' J.*, 1944, 6, No. 2, 17, 19-20. Top stud rams must possess exaggerated characters to counteract Nature's tendency to reduce the sheep's wool producing capacity. Loss of productivity is slow in becoming evident, but will ultimately be the result if extremely plain-bodied rams are used. The question of neckfolds is briefly discussed, and a plea made for uniformity of the merino type in South Africa. W.

**Plain-bodied Merino: Advantages.** B. T. Harris. *Merino Breeders' J.*, 1944, 6, No. 2, 21, 23. W.

**Plain and Developed Sheep.** C. H. Gilfillan. *Merino Breeders' J.*, 1944, 6, No. 2, 23. In South Africa, as in England and Australia, type must vary according to environment. W.

#### (C)—VEGETABLE

**Cotton: Production in Ethiopia.** F. de V. Joyce. *East African Agric. J.*, 1943, Jan. et seq. (through *Empire Cotton Grow. Rev.*, 1943, 20, 95). A discussion of the future of agriculture in Ethiopia. Imports of raw cotton, yarns and fabrics before the Italian occupation were about 7,500 tons per annum. The Italians started schemes for native production, including the establishment of ginneries in five localities and a mill capable of producing over 9,000 yards of cloth per day. This mill imported most of its cotton from India, Iran, etc. Cotton has always been grown in small patches all over Ethiopia at suitable altitudes, and coarse but useful yarn and cloth are produced. A better type of handloom would help the native industry. C.

**"Tifton Station 21" Cotton.** *Mimeogr. Paper Ga Coastal Plain Exp. Sta.*, 1942, No. 15, 2 pp. (through *Plant Breed. Abstr.*, 1944, 14, 142). Tifton Station 21 is a new cotton variety which originated as an individual plant selection from Dixie Triumph. It is a vigorously growing type suited to conditions in southern Georgia. C.

**Cotton Plants: Breeding in Queensland.** R. W. Peters. *Queensland Agric. J.*, 1943, 57, 142-146 (through *Plant Breed. Abstr.*, 1944, 14, 98). The various improvements desired by Queensland cotton breeders are outlined and an

account is given of the methods of mass selection, individual plant selection and hybridization. C.

**Cotton Plant: Hybridization.** L. M. Humphrey and A. V. Tuller. *Rev. Fac. Nac. Agron.*, Colombia, 1943, 5, No. 20, 37-41 (through *Plant Breed. Abstr.*, 1944, 14, 142). The method described consists in placing portions of drinking straw, containing the unopened anther of the pollen parent, over the emasculated flower and attaching it with copper wire. No further operation is then necessary till harvest. C.

**Cotton Plant: Natural Crossing; Effect of Corn Barriers.** O. A. Pope, D. M. Simpson and E. N. Duncan. *J. Agric. Res.*, 1944, 68, 347-361. A study was conducted for two years on the effectiveness of guard plantings of corn on natural crossing in cotton, in which four conditions of guarding were included, viz., Green-leaf adjacent to red-leaf cotton surrounded by corn; and green-leaf separated from red-leaf by 3, 6 and 9 rows of corn. The amount of natural crossing was determined by planting approximately 1,500 seeds from each row of the plots of green-leaf cotton and determining the percentage of natural hybrids. The data may be interpreted simply and directly, since equal areas were planted to green- and to red-leaf cotton. The results indicate that corn barriers are effective in reducing the amount of natural crossing and that the reduction tends toward linearity for the different barrier widths used in this experiment. Despite the indicated efficiency of barriers in reducing the amount of natural crossing, the results show clearly that the barrier widths of corn used did not afford sufficient protection, under the conditions of the experiment, for the multiplication of selfed-line seed stocks. The minimum amount of natural crossing found would in a few generations of multiplication reduce the homozygosity to a point where the seed stocks would be too badly mixed for continued production. Small-block plantings of red-leaf cotton, made at distances ranging from 700 to 4,200 ft. from green-leaf cotton, established the occurrence of natural crossing at distances up to 0.8 mile. It therefore seems clear that distances of 1 mile or more will be required to provide complete isolation, under the conditions prevailing in this study. C.

**Cotton Plant: Progeny-row Breeding.** J. B. Hutchinson and H. L. Manning. *Empire J. Exp. Agric.*, 1943, 11, 140-154 (through *Plant Breed. Abstr.*, 1944, 14, 98). The breeding histories of superfine Sea Island V<sub>135</sub> and U<sub>4</sub> cottons are described. The capacity of these varieties to respond to selection appears to be a function of the genetic variance of the material. Advantages of progeny-row breeding over mass selection are considered with special reference to the problem of conserving genetic variability. It is pointed out that analysis of breeding material should be made at intervals in order to assess the progress made in the breeding projects under consideration. C.

**Ammonium Nitrate: Use as Cotton Fertilizer.** J. J. Skinner. *Com. Fertilizer*, 1944, 68, No. 2, 18-20 (through *Chem. Abstr.*, 1944, 38, 2154<sup>9</sup>). Agronomic work comparing ammonium nitrate with other nitrogen carriers is reviewed. The value of ammonium nitrate is in most cases about the equivalent to that of sodium nitrate or ammonium sulphate. C.

**Cotton Bolls and Leaves: Water Transfer.** V. A. Novikov. *C. r. Acad. Sci. U.R.S.S.*, 1941, new series, 32, No. 4, 288-290 (through *Exp. Sta. Rec.*, 1943, 88, 30). Observations are reported that indicate that during the wilting of cotton plants, water is drawn from the bolls and absorbed, in the main, by the leaves. The bolls of Egyptian types under observation had more water than American types and suffered less from dehydration. The tendency of Upland cotton to form an abscission layer in the peduncle is partly explained on the basis of a high loss of water from the bolls when the leaves need it. C.

**Cotton Plant: Physiological Wilting in the Sudan Gezira.** A. S. Boughey. *Ann. Appl. Biol.*, 1944, 31, 12-18. Cotton wilt of physiological origin appears to have been present in the Gezira area of the Anglo-Egyptian Sudan since 1924 if not previously. The results of investigations of plant growth, soil water, and atmospheric conditions show that between mid-October and mid-December three factors occur that cause water stress in the crop. At some time during this period there is marked reduction in the size of the absorbing system of the plant, correlated with maximum boll development. Greatly increased day temperatures and higher evaporation prevail, and during the whole period

available water in the soil declines. The hypothesis is put forward that when all three factors occur at the same time at their maximum intensity, permanent wilting and death of the plants result; at lesser intensities wilting is followed by recovery, but with reduction of yield. Experiments are described that support this view. A return to the earlier sowing date formerly favoured locally should lead to considerably increased losses. C.

**Cotton Plant Diseases: Investigation in Texas.** W. N. Ezekiel and others. *Texas Sta. Rept.*, 1941, pp. 64-73 . . . 181-182 (through *Exp. Sta. Rec.*, 1943, 88, 59-60). A number of progress reports are given on problems connected with root-rot, wilt, angular leaf spot and other diseases. C.

**Cotton Plant Diseases: Occurrence in Uruguay.** A. de W. Berton. *Agric. Com. Ind., Asunción*, 1941, i, 57-59 (through *Rev. Appl. Mycol.*, 1944, 23, 176). The most serious disease of cotton in Uruguay is anthracnose (*Glomerella gossypii*). Other pathogens of the crop include *Bacterium* [*Xanthomonas*] *malvacearum*, wilt [*Fusarium*] [*?vasinfectum*], and the leaf spots caused by *Cercospora* [*?gossypina*] and *Ramularia* [*?areola*]. C.

**Jassid-resistant Cotton Varieties: Breeding.** S. Marriott. *Queensland Agric. J.* 1943, 57, 204-206 (through *Plant Breed. Abstr.*, 1944, 14, 99). In breeding for resistance to jassid attack, individual and mass selection, and hybridization were tried. Some correlation was found between hairiness and resistance, though not all hairy plants were resistant, and, under certain conditions, even the normally susceptible glabrous plants withstood attack. From mass selection, the rather heterogeneous strain known as 41J has been produced; this does not show more than a 20 per cent. increase in jassid resistance over the original non-selected strain. From individual selection methods the very uniform Miller strain 111-26 has been derived. It is of excellent quality, and  $\frac{15}{16}$ -in. staple length. It bears only a medium sized boll, however, and produces a rather leafy type of plant. Other selections from Miller also show promise. Hybridizing imported resistant types, such as the South African U4, that are useless under Queensland conditions, with some of the Queensland cottons such as Miller, and subsequently back-crossing for several generations to Miller, has produced promising lines. Their production has not yet reached a commercial scale. C.

**Co-operative Cotton Gin Associations: Organisation and Operation in New Mexico.** R. P. Callaway. *New Mexico Sta. Bul.*, No. 293, 1942, 35 pages. (through *Exp. Sta. Rec.*, 1943, 88, 120). An analysis of the financial reports and records of co-operative cotton gin associations for the seasons 1938-39 to 1940-41. In the last season there were 15 such associations in New Mexico, doing nearly 60 per cent. of all the ginning. The expenses averaged \$3.21 per 500-lb. bale. Nearly 40 per cent. of the gross income came from sales of cottonseed, 23 per cent. from sales of baled cotton and 18 per cent. from ginning and sterilization. Members received an average dividend of \$1.99 per bale. C.

**American Cotton: Marketing in Louisiana.** H. W. Little and R. A. Ballinger. *Louisiana Sta. Bul.*, No. 345, 1942, 27 pages (through *Exp. Sta. Rec.*, 1943, 88, 121). An analysis of cotton marketing practices in eight of the northern and central markets of Louisiana. About 30 per cent. of the producers had no knowledge of the quality of their cotton when they sold it and another 25 per cent. only knew what the buyer told them about the grade and staple. Nearly half of the producers knew something of the current spot and futures prices, but very few knew what were the premiums and discounts for grade and staple. Nearly half of the buyers were independent, more than 40 per cent. were salaried men, and about 10 per cent. were buying on commission. Most of the buyers made some attempt to determine grade and staple, but many of them appeared to do so very roughly and few had access to the full range of official standards for grade and staple. C.

**American Cotton Farmers: Financing.** W. S. Rowan and B. H. Luebke. *Tennessee Sta., Agric. Econ. and Rural Sociol. Dept. Monographs*, No. 136 and 137 (through *Exp. Sta. Rec.*, 1943, 88, 120). The authors analyse the use of mortgage and loan forms of credit by 51 farmers in a one-crop (cotton) system of agriculture in Hardeman County, Tennessee. Nearly half the farms had less than \$100 of debt. Land mortgages to buy the farms were the principal item.



Commercial banks and the Federal land bank each provided nearly one-third of the money. C.

**Mallow Fibres: Isolation.** A. C. Batista. *Rev. brasil. quim.* (São Paulo), 1943, 16, 340-346 (through *Chem. Abstr.*, 1944, 38, 2211<sup>7</sup>). Methods of preparing textile fibres suitable for spinning from the stalks of the tall mallow, *Pavonia varians*, are discussed, with special regard to various methods of retting for removal of pectinous substances. The fibre is fine and soft and dyes well. C.

**Cotton Bale: Sampling.** J. S. Jenkins. *Textile World*, 1944, 94, No. 5, 150-154. The writer criticises Mitchem's suggestion for the official sampling of cotton and points out that (1) considerable variations might be found in the judgments of grade and staple by different licensed classers, (2) spinning value cannot always be expressed in terms of grade and staple, and (3) there are in practice a great variety of private understandings between spinners and brokers as to the characters required in their cotton. C.

#### (D)—ARTIFICIAL

**Cellulose Pulps: Preparation from Lignite.** F. Reiff and A. W. Sohn. *Papier-Fabr.-Wochbl. Papierfabr.*, 1943, No. 3, 83-87 (through *Chem. Abstr.*, 1944, 38, 2200<sup>3</sup>). Various samples of lignite showed wide fluctuations in cellulose content and degree of polymerisation (D.P.). Usually the hemicellulose content was very low, and the samples consisted largely of cellulose, lignin and mineral matter. An unusual lignite contained 42 per cent. cellulose, D.P. 800. This in the form of small chips was given a chlorite-hypochlorite treatment similar to that used in wood delignification. Based on the weight of lignite, the sodium chlorite consumption was 100-135 per cent. The surface reaction was very rapid, but penetration into the chips was relatively slow, unless defibering was resorted to, in which case the chlorite consumption was also lowered. Pulp yields were approximately equal to the cellulose content (D.P. 800). The high degree of brightness of the pulp made further bleaching unnecessary. The pulp contained 87 per cent.  $\alpha$ -cellulose, 3.9 per cent. wood gum, 1.9 per cent. material that yielded furfural, and 13.1 per cent. alkali-soluble matter. A sulphate digestion of the same lignite yielded 24 per cent. of a pulp (D.P. 470),  $\alpha$ -cellulose 93.1 per cent., "wood gum" 2.8 per cent., furfural-yielding products 1.9 per cent., and alkali-soluble 7.1 per cent. Chlorite treatment also gave a stronger pulp than did the sulphate cook. Folding endurance was zero for the sulphate pulp and 2050 double folds for the chlorite pulp. Other lignites invariably gave lower pulp yields with less-satisfactory pulp qualities after chlorite treatment. Even within the same lignin deposit, samples showed wide variation in cellulose content and D.P., and this lack of uniformity makes effective technological utilisation impossible. Lignite cannot be considered a satisfactory raw material for the pulp mill. Photo-micrographs show fibre characteristics of lignite pulps of varied D.P.; defibrillation occurs and spirals formed in this way are insoluble in cuprammonium. C.

**Pulp for Viscose: Manufacture in Finland.** W. F. Meleshkin. *Bumazhnaya Prom.*, 1940, 18, No. 12, 8-16 (through *Chem. Zentr.*, 1941, ii, 1231 and *Chem. Abstr.*, 1944, 38, 2202<sup>3</sup>). The process followed in the Keksholm pulp mill employs acid of constant composition and bleaching in three phases, which gives better control of the viscosity of the pulp. The ash content is reduced and colour improved by repeated treatments with sulphur dioxide and water. C.

**Straw Pulp: Production.** J. Eggert. *Papier-Fabr., Wochbl. Papierfabr.*, 1943, No. 3, 87-99 (through *Chem. Abstr.*, 1944, 38, 2200<sup>3</sup>). The anatomy of rye, wheat, bamboo and other rapidly growing plants is described (20 photomicrographs) and general methods of pulping are reviewed. Modern methods involve heating the clean straw with acid at 120° C. (to hydrolyse non-cellulosic carbohydrates), neutralisation, treatment with alkali (dilute at 120-130° C., or concentrated in the cold), washing, chlorination, further treatment with mild alkali, and bleaching. C.

**Rayon Spinning Nozzle Alloys.** H. Nisimura. *Japan Nickel Rev.*, 1941, 9, 4-16 (through *Chem. Zentr.*, 1941, ii, 2893 and *Chem. Abstr.*, 1944, 38, 2200<sup>1</sup>). Tantalum and zirconium are suitable for rayon spinning nozzles; the resistance to wear of tantalum can be increased by oxidation. Gold is too soft, but alloys with platinum or gold can be used. The gold-palladium products are mostly pure solid-solution alloys, which cannot be heat-hardened, but they can be



hardened by the addition of other components. The following suitable alloys are discussed: gold-platinum (20%)–nickel (1%); gold-platinum (10%)–chromium (1%); gold–silver (5%)–aluminium (0.3%)–nickel (3.1%) and “Cohky” metal which contains gold, platinum, nickel, and another component that is not revealed. Many phase diagrams are shown and data are given on the physical and technical properties of alloys and pure metals. C.

**Rayon Filaments and Fabrics: Production.** E. Dersucher. *Ind. textile*, 1941, 57, 250; 58, 292, 330–331, 421–422 (through *Chem. Zentr.*, 1941, ii, 2757 and *Chem. Abstr.*, 1944, 38, 2199<sup>4</sup>). The composition of primary spinning baths and of the after-treatment baths is discussed. The spinning nozzles become clogged only rarely if the amounts of zinc sulphate and sulphuric acid in the primary baths are lowered and if larger amounts of magnesium sulphate are used. However, zinc sulphate cannot be replaced completely by magnesium sulphate. The impermeability and crease-proofing of natural and artificial cellulose fabrics can be improved by treatment with copper sulphate and caustic alkalis and by stretching. Additional data are given on the Carlier process of manufacturing synthetic wool, the manufacture of viscose threads with hollow spaces arranged irregularly throughout the thread, and an apparatus for the manufacture of staple fibre. C.

#### PATENTS

**Rayon Spinning Apparatus.** American Viscose Corporation. B.P.562,271 of 6/11/1942:26/6/1944 (Conv. 11/12/1941). Apparatus for the production of rayon filaments comprises a centrifugal bucket and means for draining solutions or suspensions from the immediate surroundings of the bucket into a common drainage channel leading to a discharge system, means for intermittently spraying the exterior of the bucket during operation for the purpose of removing crystals formed thereon, and means for automatically diverting the effluent from the drainage channel during spraying to a separate discharge system. The drainage system may comprise a double-chambered box for receiving the drainings, a tiltable trough for deflecting the drainings alternately into the two chambers of the box, means for tilting the trough, and means for simultaneously and intermittently operating the tilting means and the spraying means. C.

**Hydrophilic Polyamide Filaments: Production.** Imperial Chemical Industries Ltd. (E. I. Du Pont de Nemours & Co.). B.P.562,370 of 14/5/1942:29/6/1944. Polyamides having enhanced water-absorption characteristics and improved physical properties are obtained by heating in the molten state at amide-forming temperatures a mixture of at least two pre-formed synthetic linear polyamides, one at least being soluble in water and one at least insoluble, until a homogeneous melt is obtained. The changes in characteristics and properties are made more pronounced by treating the solidified melt, in whatever form desired, e.g. filaments or films, with a swelling agent, namely, water, a short-chain aliphatic alcohol, e.g. methanol, or a mixture of these. Usually, the melt-blended polyamide is formed into a structure and orientated, as by cold-drawing or cold-rolling, prior to treating with the swelling agent, and ordinarily it is permitted to shrink more or less freely during the treatment. C.

**Rayon Staple Cutter.** American Viscose Corporation. B.P.562,519 of 28/1/1943:5/7/1944 (Conv. 29/1/1942). Apparatus for cutting filamentary material at intervals into discontinuous fibres of various lengths comprises a rotating member for feeding the material to the knife and means for automatically and continually varying the speed of rotation of the member. The rotating member may feed the material radially outwards by centrifugal force and the cutting means may be adjacent to its periphery. C.

**Filament Crimping Apparatus.** American Viscose Corporation. B.P.562,520 of 29/1/1943:5/7/1944 (Conv. 31/1/1942). Apparatus for crimping filamentary material comprises a pair of projecting elements with a groove between them, a number of independently operable members, means for feeding the material transversely of the elements and groove, means for moving one of the members into clamping engagement with the material against one of the elements and means for moving another of the members into the groove

for crimping the material. The projecting elements and groove may form part of a drum having a transversely grooved surface. C.

**Cellulose Higher Fatty Acid Esters: Purification.** J. W. Fisher. B.P.562,691 of 14/12/1942:12/7/1944. Higher fatty acid esters of cellulose, and especially mixed cellulose esters of higher and lower fatty acids, which are contaminated with free higher fatty acid, are purified by extracting the acid from the ester by means of an aqueous solution of a lower aliphatic alcohol which at ordinary temperatures is completely miscible with water, the concentration of the aqueous alcohol being such that, at the temperature employed for the extraction, the cellulose ester is not substantially softened thereby. By this means it is possible to effect a substantially complete separation of the cellulose ester and the higher fatty acid, so that a cellulose ester free from uncombined acid, and a higher fatty acid free from cellulosic impurities, are obtained. The extraction is preferably carried out with aqueous ethyl alcohol at concentrations of about 50-85 per cent. and temperatures up to about 80° C. C.

**Rayon Spinning Machine.** American Viscose Corporation. B.P.562,860 of 2/11/1942:19/7/1944 (Conv. 25/10/1941). In a spinning machine for producing artificial yarns or filaments comprising a number of spinning tubes each having at one end a spinneret and at the other end an orifice through which the formed yarn or filament is withdrawn, and an inlet and outlet for a gaseous medium which is passed through the spinning tube, there is provided a duct for conveying the gaseous medium and means for supplying to the inlet of each of the spinning tubes gaseous medium from two portions of the duct, so that all the spinning tubes are supplied with gaseous medium at substantially the same temperature. C.

**Polyamide Solutions: Preparation.** E. I. Du Pont de Nemours & Co. B.P. 563,078 of 17/9/1941:28/7/1944 (Conv. 24/10/1940). Solutions of synthetic linear polyamides are prepared by dissolving the polyamides in solutions of inorganic salts in lower aliphatic alcohols. The chlorides, bromides and nitrates of lithium, calcium and zinc are particularly suitable salts. In most cases polyamide solutions of high solids content and good stability can be conveniently prepared by agitating the polyamide with the solvent mixture at room temperature or at slightly higher temperatures. In some cases, however, it is advantageous to agitate the polyamide with the solvent mixture at the boiling point of the latter, under a reflux condenser. A given solvent medium may have a swelling action on a given polyamide at room temperature, forming a rigid gel which, however, can usually be dispersed by heating. When the solution is cooled, the time interval before a gel is formed again varies with the nature of the polyamide, the solvent medium, and plasticizers or other materials present. In some cases the super-cooled solutions can be handled at room temperature for several days before gel formation occurs. It is sometimes of advantage to use an unstable solution in the formation of films, fibres, coatings, etc. For the production of dispersible particles of the polyamide, alcohol-salt-polyamide solutions are diluted with a non-solvent for the polyamide, e.g. the alcohol used in forming the solution, thus causing precipitation of the polyamide. C.

**Fibre Liquid Treatment Apparatus.** Celanese Corporation of America. U.S.P. 2,337,068. Apparatus for treating fibre with a liquid consists of an open-end trough, a perforated apron for carrying the fibre through the liquid, and transverse rollers at intervals along the trough for enclosing the liquid. C.

**Varying Denier Rayon Spinning Apparatus.** Celanese Corporation of America. U.S.P.2,337,664. The claim is for a device, employing a cam-actuated piston in a pressure cylinder, for applying a quick increase in pressure on the solution being fed to the spinneret, followed by a slow release, a period of constant pressure and then another quick increase, and so on. C.

**Crimped Filament Spinning Apparatus.** G. Bugge (Germany; vested in the U.S. Alien Property Custodian). U.S.P.2,337,969. Apparatus for producing wool-like filaments comprises a pair of opposed rollers having mating grooves of undulating form, and means for feeding spinning solution to the nip of the rollers. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Cotton Waste: Oiling.** V. V. Laikov. *Khlopchatobumazh. Prom.*, 1940, 10, No. 11-12, 20-22 (through *Chem. Zentr.*, 1941, ii, 2511 and *Chem. Abstr.*, 1944, 38, 2215<sup>3</sup>). Cotton waste mixtures are oiled to facilitate spinning. A mixture of oleic acid, machine oil, soda or ammonium hydroxide, and water is used. Various oil mixtures were tested on the same waste mixture and the tensile strength of the yarn during spinning was determined. Parallel tests were made with "Verol" alone and in mixtures with the above chemicals. Verol essentially improved the quality of the yarn and was cheaper (its composition is not disclosed). C.

**Drawing: Maintaining Balance of Supply and Demand.** *Wool Rec.*, 1944, 66, 64-68. Even a slight lack of balance between the different stages in drawing causes production to be limited to that of the slowest machines and the slowest operatives. Suggestions are made for regulating supply and demand between machine and machine, these including alterations to spindle speeds, number of doublings and draft. W.

### (B)—SPINNING AND DOUBLING

**Drafting Roller Coverings: Properties.** F. Wooding. *Textile Weekly*, 1944, 34, 148-150. The writer describes the qualities required in a drafting roller covering and favours composition cork coverings. C.

**Roving Frame Production Tables: Application.** *Textile World*, 1944, 94, No. 5, 71-78. A set of eight tables is provided from which to derive the production of roving frames under common conditions. They are based on 10-hours run, 4- and 5-roller high draft; Tables 1-4 are for  $1\frac{1}{2}$ -inch and 5-8 for  $1\frac{3}{8}$ -inch front rollers, and for each of these rollers there are tables for  $10 \times 5$ ,  $9 \times 4\frac{1}{2}$ ,  $8 \times 4$ , and  $8 \times 3\frac{3}{8}$  bobbins. The columns are headed (1) hank roving, (2) twists per inch, (3) front roller revolutions per minute, (4) time from one doffing to the next, (5) time to produce 1 lb. of sliver, (6) and (7) production at 100 per cent. efficiency in hanks and pounds, and (8)-(15) actual production after allowing 8, 9, 10 . . . . 15 minutes for each doffing. Another table gives average estimates of the percentage of time lost in piecing, week-end cleaning, etc., on frames of 90, 100, 110 . . . . 170 spindles, and the production figures derived from the main tables are intended to be corrected for the "percent. incidental stops" (other than for doffing) read from the appropriate row in the small table. Several examples are worked out to show the application of the tables. C.

**Spring-controlled Flyer Presser Arm.** T. L. McGovern (Providence, R.I.). *Textile World*, 1944, 94, No. 5, 130. Sketches are given of a presser arm which is shaped to engage one arm of the flyer and is held at the top by a collar inside which is a flat spring. The centrifugal force that tends to urge the presser foot outwards is countered by the spring so that the foot exerts uniform pressure on the roving bobbin. More compact and even bobbins are claimed. The springs can be varied so as to secure different bobbin densities. C.

**Twist: Influence in Spinning Worsted Yarn on the Bradford System.** "K.M.G.," *Wool Rec.*, 1944, 65, 970, 973. Variation in quality of tops must be provided for in twisting in drawing. If spun straight from the roving frames, more twist is needed than if the rovings are to be put into stock. The amount of twist in spinning is influenced by the system of spinning, the quality and blend of wool and other fibres, and the ultimate purpose of the yarn. Standard twists for each count are only possible in theory, because twist is affected by wool fineness and length; in the case of two-fold yarns various formulae have been suggested, but most are correct only over a limited range of counts. The best general rule is to use the minimum twist consistent with a good spin, taking into account future requirements, e.g. twisting. Coloured yarns require more twist than white ones, and special twists may be needed for special effects. Alterations in twist over small limits appear to make little difference to the two-fold strength of the yarn; the strength is increased by increase in folding twist. W.

### (D)—YARNS AND CORDS

**Rayon Tyre Cord: Production.** Industrial Rayon Corporation. *Textile World*, 1944, 94, No. 5, 79. The Industrial Rayon Corporation has planned two fac-

tories each for producing about 20 million lb. of rayon tyre cord annually. The initial 1100-denier yarn is spun, stretched, washed, treated, dried, given a preliminary twist and wound on bobbins by a continuous process. Two threads are then wound parallel on a twist spool and then cable-twisted into the finished "Tyron" cord. This is beamed from creels into 1000-lb. beams, loosely woven with a fine weft, and the cord fabric is delivered to tyre manufacturers in rolls up to 1000 yards.

C.

#### PATENTS

**Cottonized Flax Carding Machine.** Aktiebolaget Svenska Textilverken (Genevad, Sweden). B.P.562,253 of 22/12/1942:23/6/1944 (Conv. 27/12/1941). A carding machine for cottonized flax provided with one or more lickers-in, a main cylinder and a doffer, comprises in combination the following working members arranged between the lickers-in and the doffer around the main cylinder in the direction of rotation of the same: an adhesion plate for providing a uniform transfer of the material to the main cylinder, one or more rollers and clearers, stationary or movable flat carding means and a device for lifting the material outwardly on the main cylinder. The machine can also be used for the treatment of cotton or rayon staple fibre.

C.

**Fibrous and Comminuted Material Mixing Apparatus.** British Cotton Industry Research Association and T. C. Williams. B.P.562,308 of 22/9/1942:27/6/1944. For the intimate and uniform admixture of fibrous materials and comminuted materials and the production of fleeces, wads, laps, bands or slivers, means for opening and collecting fibrous material of the type described in B.P.404,686, 423,321 or 483,653 are supplemented by means for introducing into the air stream at a controlled rate the comminuted material. The latter may be fed at any or all of a number of places, first, at the entrance to the dirt chamber below the feed roller; secondly, into the space between the upper surface of the beater and the beater cover whence it is carried to where the beater strikes the fibrous material and passes with this into the dirt chamber; thirdly, on to the feed of fibrous material, the comminuted material being dropped on to laps of fibrous material as they lie on the feed lattice so that the comminuted material is "sandwiched" between the laps as they pass between the feed roller and the whole mass is disintegrated by the action of the beater; fourthly and fifthly, at two places which are less favourable for uniform admixture, i.e. respectively through an aperture in the top plate of the region between the beater and collecting means or where the air stream emerges into the region between the beater and the collecting means. To obtain any desired relative proportion of fibrous and comminuted materials, use is made of means for feeding the latter which may be regulated in relation to the feed of the former. The preferred means of regulating the feed of comminuted material is a hopper having an oscillating side, the frequency and amplitude of whose oscillations are capable of regulation.

C.

**Yarn Doubling Apparatus.** British Celanese Ltd. B.P.562,682 of 17/9/1942:12/7/1944 (Conv. 19/9/1941). A method of doubling together yarns of different twist/shrinkage characteristics comprises feeding the yarns at different rates to the feed roll of a twisting and doubling spindle and doubling the yarns with such a degree of twist that the components in the resulting yarn are substantially equal in length. The yarn that is fed at the lower rate may be drawn from the source of supply by the feed roll of the doubling machine, and the feeding of this yarn may be utilised to feed the other yarn or yarns from the source of supply at the higher rate. For carrying out this method an attachment may be mounted between the feed roll of the doubling machine and the source of supply, comprising drawing means driven by the engagement of the yarn that is to be fed at the lower speed, and serving to feed the other yarn or yarns from the source of supply at a greater speed, so that the other yarn or yarns reach the feed roll under little or no tension and consequently play little or no part in driving the drawing means. As the means for drawing the yarns from the source of supply, wheels or rollers having portions that are of different diameters may conveniently be employed.

C.

**Spinning and Twisting Frame Spindle and Sleeve.** W. W. Triggs (Spindel-Motorën u. Maschinenfabrik A.-G. vormals Weber & Co., Uster, Switzerland). B.P.562,849 of 10/7/1942:19/7/1944. A spindle and sleeve system for spinning and twisting frames is characterised in that the sleeve is made of a metallic

tube which at one end is supported on a crowned or curved shoulder of the spindle base and at the other end on a similar shoulder of the spindle head, and that the sleeve is allowed a slight axial play between the base and head in order to permit the spindle shaft to deflect resiliently without being hindered by the sleeve. The shoulders which serve as bearings for the sleeve may be provided with annular grooves, each of which contains an elastic ring which is slightly pressed against the inner surface of the sleeve. The conical tube serving as the spindle sleeve may be provided with a number of longitudinally disposed grooves which deepen toward the narrower end of the tube and which serve as stiffening ribs for the latter. C.

**Carding Engine Belt-shifter Mechanism.** J. & P. Coats Ltd. and I. P. Coats. B.P.563,056 of 11/2/1943:27/7/1944. A belt-shifter fork-member includes a limb in the form of a deep blade and another limb in the form of a rod, the limbs being connected together by a bridge component, the fork-member being pivotally mounted at its bridge end on an actuating member so that the fork-member may be swung away from and towards the associated belt pulleys, when required. The blade limb is very thin in the direction of belt-shifting movement of the fork-member and is deep in the direction perpendicular to the direction of belt-shifting movement, so as to form a guard plate of which one edge lies close to the pulleys and which is engageable with the outer edge of the belt. The fork-member is particularly applicable to a carding engine having a driving shaft carrying a loose pulley and a fast pulley each provided or associated with at least one V-grooved auxiliary pulley. The auxiliary pulleys are adapted to be used for rope drives in stripping and grinding operations. C.

**Narrow Ring Frame.** Saco-Lowell Shops. B.P.563,079 of 17/3/1942:28/7/1944 (Conv. 16/7/1941). In a two-sided ring frame, the two rows of roving bobbins are respectively mounted closely adjacent to, and directly over the two sets of drawing rollers, the back rollers of each set being set closely together and separated by a space narrower than the over-all lateral width of either set of rollers and too narrow to accommodate a creel. This arrangement permits a reduction in the width of spinning frames. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Nylon Yarn: Winding, Sizing and Weaving.** E. I. Du Pont de Nemours & Co. *Textile Manufacturer*, 1944, 70, 263-4. Practical hints are given on the preparation for weaving, and the weaving, of nylon yarns under the headings (1) winding tension, (2) knot tying, (3) oiling, (4) tinting for identification, (5) single-end sizing, (6) warping and sizing, (7) pirn winding, (8) weaving, and (9) suppression of "static" charges. C.

**Winding Machines: Efficiency, Lubrication and Maintenance.** R. F. Langford. *Textile World*, 1944, 94, No. 4, 110-111. The following particulars are tabulated. I—Production and assignment; for No. 50 "Universal," No. 90 "Universal" pirn, and No. 30 "Foster" winders. The columns are headed type of yarn, spindles per operative, average machine efficiency, production per spindle per 1, 8 and 24 hr. at 100 per cent. and at the average efficiency, and the type of package. II—Lubricating schedules for the same winders, giving the lubricating point, the frequency of lubrication, the type and viscosity of the lubricant, and the amount used. III—Maintenance schedules, with details of routine inspection, cleaning and overhaul. C.

#### (B)—SIZING

**Linseed Oil Size: Decomposition.** H. J. Henk. *Kunstseide u. Zellwolle*, 1942, 24, 304-306 (through *Chem. Zentr.*, 1942, ii, 2101 and *Chem. Abstr.*, 1944, 38, 2215<sup>4</sup>). A description is given of the processes of autoxidation, oxidative degradation of textiles, and the action of catalysts and anti-oxidants during drying and film formation. C.

**Nylon Yarn: Single-end Sizing.** R. C. Pillsbury. *Textile World*, 1944, 94, No. 4, 118-120. Full particulars are given of the sizing and coning of nylon yarn for knitting. The yarn is supplied on 1-lb. packages or re-wound on 4- or 8-oz. spools. The sizing machine imposes a positively-controlled tension before the yarn reaches the sizing roller; the tension is 3-14 gms., according to the denier of the yarn. The arc of contact with the sizing roller is set by gauge to

5°. The size is a solution of polyvinyl alcohol (8.0 per cent.), boric acid (1.6) and water (90.4); this is kept in circulation and its viscosity checked every 4 hours and maintained at 115-125 Saybolt seconds. The sizing room is maintained at  $84 \pm 2^\circ$  F. and  $50 \pm 2$  per cent. R.H.; if the limits are exceeded trouble from static charges may be expected. The sized yarn is wound on Bakelite drums, 6 ins. diameter; 8 oz. is a convenient weight. The spindle speed is 1,250 r.p.m., equivalent to a yarn speed of 685 yds. per min. on the bare cylinder, 700 yds. at  $6\frac{5}{8}$  ins. (=8 oz. of yarn) or 733 yds. at 7 ins. (=1 lb. of yarn). The sizing roller is driven by reduction gear over the range 4.9-26.5 r.p.m., and turns in the direction of yarn travel. About 4 per cent. of dry size is commonly added (=40 per cent. of actual size picked up). The sized tubes are steamed to set the twist and left for 12 to 24 hours in the sizing room and a further 12 hours in the coning room before further processing. Coning tension should be very little more than that required to pull the yarn off the sized tube; this and the applied tension together should be about 6 gms. per end at the start, and 4 gms. at the end of the cone. Pineapple cones of 8-12 oz. are usual, with  $3\frac{1}{4}$  winds across the package. Coning speed may be 1,250 r.p.m. or 285 yd. per min. at the start of a  $3\frac{1}{4}$  in. cone. The room should be at  $76^\circ$  F. and 72 per cent. R.H. C.

**Nylon Yarn: Single-end Sizing.** *Textile Manufacturer*, 1944, 70, 307. An illustration is given of a "flash defect" that may be found in fully-fashioned nylon stockings if there are short-period irregularities of twist in the yarn. The defect takes the form of skewed stitches which show up as streaks and furrows in the dyed stocking. Recommendations are made for the winding tension and the sizing of the yarn before crêpe twisting, coning and oiling so as to avoid the defect. Du Pont's size for nylon is mainly a partly saponified polyvinyl acetate, with boric acid and polyethyleneglycol. Two sizing, twisting and oiling experiments are reported in which the range of twists per 2½-inch lengths of yarn were 58-87 and 71-82, respectively (averages 75). Fully-fashioned stockings made from these yarns were free from the above defect. C.

#### (C)—WEAVING

**Automatic Loom Shed: Staffing.** H. de G. Gaudin. *Textile Manufacturer*, 1944, 70, 284. The writer gives an estimate of the number of workers required for a shed with 180 automatic rayon looms on one shift and on two shifts. The total for two shifts is 56 persons, whereas Lowcock gave the figure 102 for 175 looms, or very little less than the number that would be required on non-automatic looms. Lowcock's article is strongly criticised. C.

**Wire Weaving Looms.** Robert Hall & Sons (Bury) Ltd. *Textile Manufacturer*, 1944, 70, 257-9, 269. A general account is given of the weaving of wire and mono-filaments, followed by details of shuttle looms suitable for (1) light wire cloths of 8-120 meshes per inch and wire of 28s-42s gauge, (2) medium cloths of 8-80 meshes and 25s-38s gauge, and (3) heavy cloths up to 26s gauge. C.

**Plain Fabrics: Obtaining "Cover" in Weaving.** *Indian Textile J.*, 1944, 54, 228-229. Practical hints are given on loom settings to secure good "cover" in weaving plain fabrics. C.

**Shuttle-changing: Influence on Weaving Efficiency.** T. Oliver. *Wool Rec.*, 1944, 65, 880. Reference is made to a previous article (these *Abs.*, 1944, A337) and a simple mathematical analysis given of the problem of weaving efficiency in relation to count of yarn and shuttle-changing. W.

#### (D)—KNITTING

**Knitting Machine Needles: Straightening.** J. C. Cobert. *Cotton (U.S.)*, 1943, 107, No. 11, 134-5. A simple and quick plan is given for teaching the operative how to see and correct needle defects, and a needle inspector's report form is reproduced. C.

**Knitting Yarns: Selection.** C. W. Bendigo. *Textile World*, 1944, 94, No. 4, 81-88. A series of tables are provided to show the sizes of rayon (and pre-war nylon), cotton, worsted and woollen yarns suitable for the various parts of (1) fully-fashioned hosiery, (2) women's seamless hosiery, (3) men's half hose, (4) underwear, and (5) outerwear. The tables are divided into sections, e.g. leg, welt, reinforced heel and sole and toe, and in each section the columns give the

machine gauges, minimum, maximum and normal yarn counts, and folding twists. C.

**Fully-fashioned Hosiery Machines: Development.** P. Kroener. *Textile World*, 1944, 94, No. 5, 97. The writer discusses the limitations to gauge and speed in fully-fashioned knitting machines and forecasts a post-war machine in 30 sections, gauge 51 and 14-inch needle bars to cover the range of 15- to 40-den. nylon or 2- to 7-thread silk. C.

#### (G)—FABRICS

**Nylon Corset Cloths: Development.** Katherine Mackenzie. *Textile Manufacturer*, 1944, 70, 265 (from *Canadian Textile Journal*). The writer refers to work at the Ontario Research Foundation by the Nylon Division of Canadian Industries Ltd. on the development of nylon yarns for other purposes than stockings. A marquisette for corsets and underwear shows much promise. C.

**U.S. Army Wool Socks.** *Text. World*, 1944, 94, No. 3, 93, 152. Manufacturing data are given for spinning merino yarn for U.S. army socks (light-weight wool and cushion-sole) on the worsted and cotton systems. Lowering the grade of wool used has reduced shrinkage by one-third (see these *Abs.*, 1944, A146). W.

#### PATENTS

**Knitting Machine Fabric Take-up Mechanism.** Hemphill Co. (U.S.A.) and R. C. Southworth. B.P.562,247 of 21/10/1942:23/6/1944 (Conv. 23/10/1941). Fabric take-up mechanism for knitting machines comprises opposed rollers mounted so as to be capable of swinging or moving apart to accommodate different thicknesses of fabric passing between them, yielding means for resiliently urging the rollers towards one another, and a pawl and ratchet device for driving each roller independently at any position it may take up. C.

**Wear-resistant Canvas Hosepipe.** Lewis & Taylor Ltd. and N. Lawson. B.P. 562,326 of 1/2/1943:27/6/1944. Seamless woven canvas hosepipe is composed of warp and weft threads with some of the warp threads standing out or lying beyond the remaining surface of the hosepipe for the purpose of providing a wear-resisting face. The wear-resisting threads are introduced parallel with the ordinary warp threads and fed into the loom at a higher rate than the ordinary warp threads. They may be of the same or different material from the ordinary warp threads. C.

**Constant Tension Winding Machine.** Slack & Parr Ltd. and H. Slack. B.P. 562,622 of 12/1/1943:10/7/1944. In an arrangement for keeping the pull on the thread or other material being wound substantially constant as the bobbin fills up, the winding bobbin is driven by means comprising a set of permanent magnets, a prime mover for rotating them to produce a rotating magnetic field, and an associated rotor coupled to the bobbin, the rotor being of squirrel cage construction, but modified so as to be capable of developing a large slip. C.

**Two-piece Stocking.** E. Dickinson. B.P.562,926 of 19/2/1943:21/7/1944. A stocking is made in one portion that comprises the leg and a part of the foot, and a second portion forming the toe and part of the foot. In use one portion overlaps the other and the two may be fastened together with suitable material. The length of the overlap is such that any creep of the two portions does not allow them to separate. C.

**Glass Fibre Wicks.** H. H. Goldstaub. B.P.563,050 of 5/1/1943:27/7/1944. A wick is composed wholly or mainly of glass fibres and has an end or edge temporarily or permanently sealed by the application of heat to the fibres accompanied either by tension or some compacting or shaping process to facilitate assembly in a wick holder or use therein or for both purposes. A method of compacting and tapering the edge or end of a glass-fibre thread or fabric comprises applying heat at an intermediate region or point while stretched until severance occurs at the heated region. If desired, cotton fibres or the like may be incorporated with the glass fibres, but it is preferred that the bulk of the wick shall comprise glass fibres. C.

**Mesh Fabric Knitting Machine.** Harry Harris (Tuckerton, N.J.). U.S.P. 2,337,102. The claim is for a machine with a straight series of needles, cam-actuated narrowing mechanism supporting a picot comb that can shift endwise along the needles to transfer loops between certain spaced needles (a) and



adjacent needles (*b*) incidental to the dipping, lifting and dipping of the narrowing mechanism in loop transferring operation, and a pair of cams for shifting the picot comb as required either between the first and second dips as loops are transferred from needles (*a*) to needles (*b*) or before the first dip as loops are transferred from (*b*) to (*a*). C.

**Warping Machine Compacting Device.** Davis & Furber Machine Co. U.S.P. 2,337,129. A device for compressing warp as it is being wound on a beam comprises a base carrying a main shaft that is fixed parallel to the beam, upstanding arms journaled to the main shaft and to compressor rollers, a tension shaft in front of the upstanding arms carried on bearings from the main shaft, means connecting each arm to the tension shaft acting to turn this shaft as the beam grows, and means supported from the main shaft to restrain the turning of the tension shaft so as to maintain uniform pressure on the warp by the compressor rollers. C.

**Circular Independent Needle Knitting Machine Loop Forming Mechanism.** Hemphill Co. U.S.P. 2,337,153. The sinkers have two surfaces at different levels over which loops may be measured and drawn by the needles, and selecting mechanism is used to control the jacks so that they take either one or other of two pathways as they actuate the sinkers and cause short or long loops to be drawn. C.

**Circular Independent Needle Knitting Machine Yarn Feeding Mechanism.** Hemphill Co. U.S.P. 2,337,187. The claim is for a trimmer and binder, supported very close to and outside the circle of needles, but within the carrier ring, that is pivotally mounted so as to swing tangentially to and from a feeding position close to the needles and also to move upwards on being retracted from the needles and downwards on swinging in to feed. C.

**Raised Pattern Knitted Fabric.** Hemphill Co. U.S.P. 2,337,189. A plain fabric has portions standing out from the face wherein two yarns are knitted in consecutive courses, one in all wales and the other in spaced wales only, whilst in the remaining lower levels of the fabric both yarns are knitted in all wales, at least some of both areas occurring in the same courses. C.

**Plain Knit Elastic Fabric.** Hemphill Co. U.S.P. 2,337,211. The claim is for a fabric composed of alternate courses of (*a*) inelastic and (*b*) elastic yarns, (*a*) being knitted in every wale and (*b*) being knitted in alternate wales and tucked with loops of (*a*) in the other wales. C.

**Running Filament Liquid Treatment Device.** Grove Silk Co. U.S.P. 2,337,357. A strip of metal is bent medially and upon itself to form a kind of clip, and also bent into loops at the ends by which it can be supported in a pool of liquid. Capillary action causes the liquid to rise in the space between the two prongs and the yarn is carried through this portion of the liquid. C.

**Loom Beat-up Mechanism.** Crompton & Knowles Loom Works. U.S.P. 2,337,431. Means are provided to raise the reed with respect to the warp shed, first toward and then from the fell of the cloth, in timed relation with the picking motion. C.

**Bobbin Tube.** American Paper Tube Co. U.S.P. 2,337,438. The bobbin has a tubular barrel with outwardly flaring conical flange (*a*), an annular head (*b*) with conical counter-bore engaging (*a*), and an annular ferrule to hold (*a*) and (*b*) tightly together. C.

**Moulded Bobbin.** Kilgore Manufacturing Co. U.S.P. 2,337,770. A moulded, hollow bobbin is formed in two parts telescoped together and united to present a smooth, hard, resilient and substantially jointless surface for the yarn. At least one end is furnished along its inner edge with ratchet means. C.

**Loom Box Motion Lever.** Crompton & Knowles Loom Works. U.S.P. 2,337,896. The claim is for wedge means between the lever arm and a finger mounted on the arm, whereby a gudgeon on the other end of the finger is moved towards or away from the lever axis. C.

**Braiding Machine.** B. F. Goodrich Co. U.S.P. 2,337,977. The machine comprises a bobbin carrier, a single eye tensioning and guiding means for regulating the tension in the group of yarns as a whole, means for simultaneously applying tension to all the bobbins, and means controlled by the tension of a bight of a yarn for automatically relieving excessive tension on at least one of the yarns. C.



**Packing Braid.** E. I. Du Pont de Nemours & Co. U.S.P.2,337,986. The packing material comprises a number of ropes of continuous-filament regenerated cellulose rayon having an inherent and permanent crimp, the crimps in the several filaments being out of phase with each other. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (A)—PREPARATORY PROCESSES

**Soap: Application in Textile Processing.** Georgia Leffingwell and M. A. Lesser. *Rayon Textile Monthly*, 1944, 25, 188-189. Typical recipes are given in which soap is an ingredient of sizing, bleaching, dyeing, finishing and proofing agents. Relevant literature is briefly reviewed. C.

**Surface-active Agents: Application in Paper Making.** J. J. Miskel. *Paper Trade J.*, 1944, 118, TAPPI, 233-238. A useful review of the chemistry of surface-active agents of (1) the anionic (soaps, sulphated oils and esters, aliphatic alcohol sulphates and sulphonates, ester sulphates and sulphonates and alkyl-aryl sulphonates), (2) cationic (quaternary ammonium salts, etc.) and (3) non-ionic types (polyhydroxy alcohol esters and polyethylene oxide products), with special reference to applications in the paper industry. C.

**Textile Assistants: Application.** J. Hetzer. *Leipzig. Monats. Textil-Ind.*, 1941, 56, 132-134, 150-152, 174-175, 202-203 (through *Chem. Zentr.*, 1941, ii, 3014 and *Chem. Abstr.*, 1944, 38, 2503<sup>5</sup>). Methods are described for the softening of water, the prevention of the formation of calcium soap, the solution of calcium soap, the making of paste and solution of dyes, the preparation of emulsions, the washing of wool, carbonisation and fulling, the chlorination of wool, the protection of wool against moths and chemicals, the reserving of wool, the degumming of crude silk and its reserving. C.

##### (B)—BOILING, SCOURING, DEGUMMING, AND WASHING

**Silk: Degumming.** K. M. Markuze and V. I. Maleev. *Tekstil-Prom.*, 1941, No. 3, 36-39 (through *Chem. Zentr.*, 1942, ii, 1867 and *Chem. Abstr.*, 1944, 38, 2213<sup>6</sup>). The best degumming agent appears to be olive-oil soap, which forms stable emulsions, and can be readily removed by washing. The degumming properties appear to be due to the alkalinity of the medium rather than to detergent power.<sup>1</sup> In order to hasten the boiling-off process, the hydrogen-ion concentration should remain as nearly constant as possible during the operation. A buffer mixture of sodium carbonate and sodium bisulphite is recommended for this purpose. Three tables give details of the use of chemicals, results of the various tests, and the strength of the warp and weft of various fabrics. The advantages of the process depend on the rapidity of the operation at low temperatures and with low concentrations of soap solutions. C.

**Quaternary Compound Textile Assistants: Application.** G. Gaudry. *Ind. textile*, 1941, 58, 337, 380-381 (through *Chem. Zentr.*, 1941, ii, 3123 and *Chem. Abstr.*, 1944, 38, 2503<sup>7</sup>). Fixanol and Sapamin KW are suitable for the fixation of rubber on wool and for the improvement of the washing-fastness of direct dyeings on cotton. Lisolamine helps in the stripping of dyeings and Leukotrop OW, a dimethylbenzyl-ammonium chloride is used for coloured discharging on an indigo base; similar products with substituted benzyl groups are suitable for white discharging. Quaternary compounds can be used to cause cotton to absorb acid dyes. New quaternary compounds containing a fatty alcohol radical in the molecule serve as dispersing agents in vat dyeing. A compound for use as a retarding agent in vat dyeing comprises a benzoic acid derivative in which an aliphatic radical is joined to the main molecule by means of an ester group. Stable dull finishes on rayon can be obtained by means of surface-active compounds and zinc sulphate, barium sulphate or titanium dioxide. Wool can be impregnated with latex with the aid of quaternary compounds. C.

**Silk Waste: Degumming.** P. P. Viktorov and I. I. Kuhn. *Shelk*, 1940, 10, No. 11, 10-13 (through *Chem. Zentr.*, 1941, i, 3606 and *Chem. Abstr.*, 1944, 38, 2499<sup>8</sup>). Silk waste (50 g.) was placed in an autoclave at 50°, and boiled at 120° for 30 min. or at 130° for 60 min. The whole process including the heating of the water to 50°, boiling, cooling and washing of the sample took 2-2.5 hours. Boilings with neutral soap, with soap-soda mixture, with caustic soda, and with a mixture of caustic soda and commercial sodium bisulphite (38° Bé) were

studied. The boiled samples were cleaned and tested for strength, elongation and contents of sericin, fats, soap and ash. Comprehensive tables of experimental results are given in the original Russian paper. C.

**Synthetic Detergents.** F. D. Snell. *Soap*, 1943, 19, No. 10, 27-30, No. 11, 31-33, 74. The composition, characteristics (especially wetting and emulsifying power), and textile and other applications are described of the more common non-soap detergents (esters, ethers, amides, alkyl aryl sulphonates and cation-active agents). W.

**Scouring and Heavy Milling: Precautions against Stains.** *Dyer*, 1944, 92, 53-55. The scouring and milling is described of a special war-time cloth required to be finished in a natural wool shade to stipulated strength, pH value and thickness. A rubber roller scouring machine with a roller gap of about  $\frac{1}{8}$  in. was used to save the strength of the weft; details of processing treatment are given. To avoid stains in milling, all metal parts of the machine should be thoroughly cleaned, painted with a good quality aluminium paint and tightly wrapped with a clean material. Stains traced to the centres of the rollers can be avoided by dismantling the rollers, cleaning them and leading or galvanizing the iron parts; other methods consist of fitting thin brass or stainless steel plates over the centre, or of completely making up the centre opening by inserting wood pieces cut to shape. Stiff cloths may be stained by being forced against the back of the machine before falling into the bottom, and the back of the machine should therefore be well cleaned. Pieces may be forced out of the machine if the back door is not properly fastened, causing staining and possible damage to fabric if the rollers continue to revolve when the drafts have drawn tight. High temperatures may cause distortion of the wood parts of the machine, particularly the trough and its lid. W.

#### (C)—BLEACHING

**Hydrogen Peroxide Bleaching Bath Stabilizers.** P. Colomb. *Teintex*, 1941, 6, 222-226 (through *Chem. Zentr.*, 1941, ii, 3140 and *Chem. Abstr.*, 1944, 38, 2215<sup>2</sup>). A discussion of the patent and trade literature dealing with stabilizers such as  $\text{Na}_2\text{H}$  and  $\text{NaH}_2$  phosphates, boric acid, borates, aromatic amines, barium and magnesium salts, higher aliphatic alcohols, tin salts, starch, benzene and xylene. Practical examples for hydrogen peroxide bleaches with the addition of sodium pyrophosphate or phosphate are described. C.

**Sodium Bicarbonate: Application in "Souring."** A. L. Dubeau and H. R. Dinges. *Amer. Dyes. Rept.*, 1944, 33, 219-220. Advantages claimed for the replacement of sulphuric acid by 3 per cent. bicarbonate solution at 140-160° F. in (a) the open-width rinsing of heavy fabrics after scouring or mercerizing, (b) warp mercerizing, (c) removing caustic soda after kiering, and (d) removing caustic soda after steaming and before bleaching, in a new continuous bleaching process are (1) the possibility of hot washes, (2) relaxation of chemical control and (3) reduction of the number of steps, in some cases. C.

**Cellulose Fibre: Bleaching.** P. P. Viktorov. *Tekstil. Prom.*, 1941, No. 1, 46-48 (through *Chem. Zentr.*, 1942, ii, 2100 and *Chem. Abstr.*, 1944, 38, 2483<sup>4</sup>). The author starts from the idea that the alteration of physical properties of the cellulose fibre by chemical attack constitutes a deciding factor in its purification by bleaching. During the process of removing pectin from the cotton fibre, its physical condition is changed. Assuming a chemical bond between the cellulose and pectin, the author concludes that the rupture of this bond is accomplished with greater ease, yielding a better product, by treatment with oxidising agents and mineral acids rather than by boiling with caustic soda. The first method serves to spare the natural fats and waxes, leaving the elastic properties of the fibres intact. By subsequent treatment at higher temperature with a sodium hypochlorite solution, stabilised with water glass, a product completely free from lignin can be obtained. C.

**Percarbonates: Use in the Textile Industry.** J. Salquain. *Teintex*, 1942, 7, 164-166 (through *Chem. Zentr.*, 1942, ii, 1865 and *Chem. Abstr.*, 1944, 38, 2503<sup>3</sup>). Permonocarbonates are produced by the action of carbon dioxide on sodium or barium peroxide. Barium percarbonate, a pale-yellow, water-insoluble powder is decomposed by water into barium carbonate and hydrogen peroxide. Perdicarbonates are produced in 80 per cent. yield during the anodic oxidation of a saturated carbonate solution. Potassium perdicarbonate, blue

and hygroscopic, decomposes with the evolution of oxygen on heating; the addition of water at 50° produces hydrogen peroxide. The commercial product is a sodium perdicarbonate-hydrogen peroxide compound,  $\text{Na}_2\text{C}_2\text{O}_6 \cdot n\text{H}_2\text{O}_2$ . Per-carbonates in alkaline solutions are suitable for bleaching vegetable fibres, and in acid solutions for bleaching wool. They are suitable also as antichlor, for oxidising agents for vat leuco dyes, washing and boiling-out agents. C.

**Permanganate: Use in Bleaching.** G. Frische. *Deut. Färber-Ztg.*, 1941, 77, 273 (through *Chem. Zentr.*, 1941, ii, 2635 and *Chem. Abstr.*, 1944, 38, 2503<sup>41</sup>). The use of K permanganate in the bleaching and the spotting of fabrics, the treatment of cotton and rayon, the reduction by sulphur dioxide of the manganese dioxide formed, and the addition of magnesium sulphate during the bleaching of wool in order to bind the caustic alkali formed are discussed. For spotting, the sulphur dioxide is replaced by hydrogen peroxide, since the bleaching effect is increased by the double oxidation. C.

#### (I)—DYEING

**Aminoguanidine Azo Dyes: Production.** R. N. Shreve, R. P. Carter and J. M. Willis. *Ind. Eng. Chem.*, 1944, 36, 423-430. Aminoguanidine is obtained by electrolytic reduction of nitroguanidine. This is prepared by the dehydration with sulphuric acid of guanidinium nitrate which, in turn, is obtained from dicyandiamide. Aminoguanidine has been diazotised and hot-coupled with various intermediates, including  $\alpha$ - and  $\beta$ -naphthol and naphthylamine, Tobias acid, and *o*- and *p*-nitroaniline. Azo dyes having good dyeing properties on animal fibres, such as silk and wool, particularly in conjunction with a mordant, were obtained. When applied with a tannin mordant, the dyes gave chiefly brown and orange shades on wool. Tests indicated good fastness to light, rubbing, boiling acids, and dilute bleaching powder solution. C.

**Portable Dyehouse Equipment: Advantages.** Althouse Chemical Co. *Amer. Dyes. Rept.*, 1944, 33, 193-195 (from *Chem. & Met. Eng.*, 1944, January). An illustrated account of the advantages of "equipment on wheels" in the dyehouse, showing (1) a chlorine supply, (2) a filter press, (3) a pyrex heat exchanger, (4) a pump, and (5) a weighing machine. C.

**Cotton Yarn Packages: Vat Dyeing.** O. W. Clark. *Textile World*, 1944, 94, No. 4, 107-109. The factors that make for level package dyeing are analysed with the help of longitudinal sections of dyed yarn packages. These show (1) the influence of tightness of winding, (2) the advantage of increasing the rate of circulation from 2 to 4 and 8 gallons of dye liquor per package per minute, (3) the influence of the weight of the package (12, 20 and 32 oz.) and the advantage of increasing the rate of circulation, (4) the advantage, in some cases, of increasing the temperature of the bath (120 to 180° F.), (5) the advantage of slowly raising the temperature, from 70 to 120° F., with a dye that exhausts very rapidly at the higher temperature, and (6) the advantage of an appropriate dye-bath assistant. Suitable procedures are summarised for dyeing (1) slate blue on 500 lb. of 50s/4 cotton yarn, 24-oz. packages, without levelling agents, (2) baby blue on 100 lb. of 60s/3 mercerized Sakel yarn, 24-oz. packages, with the help of a levelling agent and a high rate of flow, and (3) green on 100 lb. of 40s/2, 24 oz. packages, without reversal of flow. C.

**Wollstra Yarns: Dyeing.** R. Hünlich. *Leipzig. Monatschr. Textil-Ind.*, 1941, No. 2, 34-35 (through *Chem. Zentr.*, 1941, ii, 2496-2497 and *Chem. Abstr.*, 1944, 38, 2211<sup>7</sup>). When washing of Wollstra yarns before dyeing is necessary, Igepon, Gardinol, Lamepon or a similar preparation may be used. If the wool is soiled with free fatty acids 0.25-0.75 g. of sodium carbonate per l. is added to the wash liquid. Preliminary bleaching is necessary only for white or light colours; this is done by treating the yarn first with potassium permanganate and magnesium sulphate, then with sodium bisulphite and formaldehyde. If the wool is to be dyed and the Vistra (rayon) to remain white, levelling and acid dyes are used; very fast colours are obtained with chrome dyes. If mixtures are to be dyed in which the wool and Vistra dye differently, either a 1- or a 2-bath method may be used. The wool is dyed with dyes which act predominantly on animal fibres when used in neutral sodium sulphate baths, whilst the Vistra is dyed with a suitable substantive dye by the addition of Katanol WL. When the two-bath method is used, the material is first dyed with the levelling or weakly acid dye and then dyed with the substantive dye in a fresh bath. Fast

colours are obtained by dyeing the Vistra with diazo dyes, diazotising and developing, then dyeing the wool with acid dyes in a boiling acid bath. C.

**Dyehouse Colour Matching Problems.** (1) F. T. Simon and E. I. Stearns. (2) Dorothy Nickerson. *Amer. Dyes. Rept.*, 1944, 33, 232-235, 251; 252-256. (1) The authors provide a series of answers to the general question "Why small colour differences are important in textiles," and point out the need for improvement in the "tolerance limits" to colour differences. (2) A summary is given of available information on the following formulæ for expressing small colour differences: (a) Nickerson's "Index of fading" (1936), (b) the same modified according to Balinkin (1941) to agree with Euclidean space, (c) the Judd index (1939), (d) the Hunter-Scofield modification of the Judd index (1942 and 1943), (e) based on Adams's "chromatic value" (1942), and (f) based on Adams's "chromatic valence" (1943). C.

**Bronze-like Indigo Dyeings: Production.** A. Simonet. *Teintex*, 1942, 7, 173-174 (through *Chem. Zentr.*, 1942, ii, 2088 and *Chem. Abstr.*, 1944, 38, 2493<sup>9</sup>). Bronze-like dyeings on cotton are produced by a ferrous sulphate-calcium oxide vat treatment. In order to use the more convenient hydro-sulphite vat the fabric is dyed first with a sulphur black, e.g. Noir Sulfanol extra conc. (Kuhlmann) or Aniline Black. Later it is dyed twice with Indigo NTS (Kuhlmann). C.

**Delustred Acetate Rayon: Improvement of Light-Fastness.** H. Lohmann and Paula Braun. *Zellwolle, Kunstseide, Seide*, 1941, 46, 90-92 (through *Chem. Zentr.*, 1941, i, 3586 and *Chem. Abstr.*, 1944, 38, 2496<sup>9</sup>). Rayons delustred with pigments are less resistant to light than are lustrous rayons, and many dyes are less fast to light on dull rayon. These differences in light fastness apply only to visible light; in mercury light the two fibres lose strength equally quickly. According to German and French patents of the Deutsch Acetat-Kunstseiden A.-G. "Rhodiaseta" the light fastness of rayons from cellulose or cellulose derivatives is improved by adding bivalent manganese salts to the spinning solution or by impregnating the fibre with the salts. C.

**Rayon Staple Fibre: Dyeing with Sulphur Dyes.** E. Köster. *Textilberichte*, 1943, 24, 265-266 (through *Chem. Abstr.*, 1944, 38, 2495<sup>9</sup>). Dyeings below 40° are not practical. Temperatures of 40-50° are recommended. Suitable Immediate dyes are listed and dyeing procedures are described. C.

**Spun Rayon Goods: Dyeing with Substantive Dyes.** H. Schumacher. *Textilberichte*, 1943, 24, 231-233, 268-271 (through *Chem. Abstr.*, 1944, 38, 2496<sup>9</sup>). Numerous dyes tested are tabulated and classified as cold-, intermediate- and hot-dyeing dyes. The dye-absorption velocity and the establishment of the state of saturation, large-scale test, the levelling of the dyeing, streakiness, localised inequalities, thorough dyeing of the fabric, fastness of the dyeing and saving in steam are discussed. The temperature of maximum dye absorption differs for the various dyes, and is not related to absorption velocity. The dye consumption does not increase, but may decrease in cold dyeing. The time needed for the establishment of the state of solution is approximately the same for cold and hot dyeing. Level dyeing and good penetration can be obtained less readily with cold-dyeing than with hot-dyeing dyes. The fastness of a cold dyeing, generally, is not inferior to that of a hot dyeing. C.

**Spun Rayon-Wool and -Cotton Mixtures: Dyeing.** W. Kegel. *Deut. Textil-wirt.*, 1941, 8, No. 14, 25-26 (through *Chem. Zentr.*, 1941, ii, 3123 and *Chem. Abstr.*, 1944, 38, 2495<sup>9</sup>). The pre-cleaning of spun rayon yarns with good wetting and washing agents and fat solvents, if necessary with the addition of some Oxycarnit L50 is discussed. Mixtures with wool can be dyed in a single bath with semi-wool dyes or in a double bath with diazo dyes and acid wool dyes. Mixtures with cotton are dyed with light-fast Sirius or Sirius Light dyes or washing-fast with diazotisation dyes. Fulling-fast dyeings are obtained with sulphur dyes; effects fast to light and washing are produced with indanthrene dyes. Spun acetate rayon is dyed with Celliton or Celliton Fast dyes; mixtures with wool are treated in single or double baths with the addition of acid dyes, and mixtures with cotton are dyed with cotton dyes "Type 8000." Acetate with semi-wool is dyed with the addition of Gardinol OTS or with Plurafil dyes with the aid of Igepon T. C.

**Superpolyamides: Action of Acids and Dye Acids.** E. Elöd and T. Schachowskoy. *Textilberichte*, 1942, 23, 437-440 (through *Chem. Zentr.*, 1942, ii, 2643 and *Chem. Abstr.*, 1944, 38, 2493<sup>5</sup>). Absorption of Crystal Ponceau 6R by superpolyamides increases strongly with increasing H-ion concentration; this increase, unlike that of the proteins, does not pass through a maximum. The swelling of the superpolyamides in water does not depend on the pH of the swelling medium; this also is different from the behaviour of proteins. Acid-binding property of superpolyamides increases up to a 2N hydrochloric acid solution without passing through a maximum. It is assumed that the NH<sub>2</sub> groups do not enter in these reactions, but that NH groups and adsorptive phenomena are responsible for these acid and dye acid reactions. C.

**Acid Colours: Tinctorial Aspects.** *Dyer*, 1944, 91, 429-431, 505-507, 515; 92, 24-27. The tinctorial function is discussed of the component acid colours in simple and compound shades of yellow, orange, pink, mauve and violet, blue, black, scarlet and green on animal fibres. Practical hints are given on choice of dyestuffs and methods of application, and corrective measures suggested for off-shade lots. W.

**Dyeing of Acid and Chrome Colours on Wool with Phosphoric Acid.** E. I. Noble. *Text. J. Australia*, 1944, 19, 71-77. A brief survey is given of the colloidal, semi-dispersed and dispersed dyes, and of the principles of their application. The behaviour of phosphoric acid in wool dyeing and the chemical theory of the process are discussed. Slubbing was dyed at 90° C. for 1½ hr. in a liquor to wool ratio of 30:1, to compare the dyeing properties of acetic, formic, sulphuric and phosphoric acids. The results showed that phosphoric (75 per cent. acid) may be used instead of formic and acetic acids with a large reduction in dyeing costs. It could replace sulphuric acid with better levelling and penetration and less damage to the wool and any cellulosic fibres present. Buffered with soda ash, it is suggested as a perfect substitute for acetic acid. It is a rustproofing agent, and when used with bichrome for dyeing chrome colours in dyeing machines containing iron, prevents rust and rust stains. The suggested volume requirements for sulphuric acid (96 per cent.), formic acid (90 per cent.) and acetic acid (60 per cent.) per 1 pint of phosphoric acid (75 per cent.) are sulphuric, 0.66, formic, 1, and acetic, 3. Calgon may be added to phosphoric acid dyebaths with advantage, particularly with chrome colours, thereby preventing possible dulling due to the traces of iron and some calcium sulphate which occur in the present war-time phosphoric acid made in Australia. W.

#### (J)—PRINTING

**Cotton and Rayon Piece Goods: Printing.** A. E. Hirst. *Cotton (U.S.)*, 1943, 107, No. 12, 79-82; 1944, 108, No. 1, 75-78; No. 2, 102-104; No. 3, 98-101, 114; No. 4, 109-112, 124; No. 5, 99-101; No. 6, 97-100. An illustrated review of modern practice under the headings (1) Preliminary processes (singeing, de-sizing, scouring, bleaching); (2) The white room (drying, dyeing, preparing colours); (3) Printing colours (dyes, thickeners, etc.); (4) Roller engraving; (5) The printing machine and its operation; (6) The ageing and soaping of piece-goods (with diagrams of the plant); (7) Finishing operations (stentering, calendering, Sanforizing, etc.). C.

**Formaldehyde-treated Spun Rayon: Printing.** M. Kerth. *Textilberichte*, 1943, 24, 233-234 (through *Chem. Abstr.*, 1944, 38, 2496<sup>8</sup>). Formaldehyde-treated spun rayon will give good results in alkali printing on a Naphthol AS base without any special pre-treatment, but such staple fibre is not suitable for printing with aniline black and diphenyl black. A pre-treatment of the goods with caustic soda improves its behaviour toward vat and Rapidogen dyes and also toward Anthrasol dyes according to the nitrite process. The use of caustic soda does not affect the swelling. C.

**Glucose: Application in Printing.** F. R. Naumov and T. E. Pisareva. *Khlopatobumazh. Prom.*, 1940, 10, No. 11-12, 41-43 (through *Chem. Zentr.*, 1941, ii, 2497 and *Chem. Abstr.*, 1944, 38, 2493<sup>7</sup>). Printing experiments were carried out with a glucose which contained 35-40 per cent. of reducing agents and therefore had about the same reducing power as hydrosulphite, although its manner of action was different. Hydrosulphite decomposes readily with the liberation of active hydrogen. Glucose, on the other hand, is itself reduced to alcohol by hydrogen. The aldehydic hydrogen of glucose readily combines with

oxygen, with conversion of the carbonyl group into an acid group. Printing experiments with vat dyes of Russian manufacture are described in detail. The results indicate that Bromo Indigo, Thio Indigo S, Thio Indigo Scarlet GG, Helindon Orange R, and Vat Red KH can be printed with glucose without essential change in shade. Indanthrene Yellow G, Indanthrene Golden Yellow GK, Indanthrene Brilliant Green B, Indanthrene Brilliant Violet RR, Indanthrene Dark Blue BO and Helindon Yellow all give satisfactory prints when the rongalite-glucose process is used. C.

#### (K)—FINISHING

**Rayon: Delustring.** J. Besançon. *Teintex*, 1940, 5, 299-300 (through *Chem. Zentr.*, 1941, i, 3462-3463 and *Chem. Abstr.*, 1944, 38, 2215<sup>1</sup>). Impregnating the fibres with barium hydroxide, washing and then treating with sodium stannate produces a dull finish fast to washing. Sodium stannate treatment can also be used with calcium salts. C.

**Chitosan: Preparation and Use as Fabric Dressing.** F. I. Sadov. *Tekstil. Prom.*, 1941, No. 2, 52-54 (through *Chem. Zentr.*, 1942, ii, 2101 and *Chem. Abstr.*, 1944, 38, 2215<sup>6</sup>). Chitosan, a yellow powder easily soluble in 1-2 per cent. acetic acid giving a highly viscous glass-clear mass, is obtained from chitin by treatment with caustic soda solution. Laboratory experiments indicate that chitosan can replace starch, yields a textile dressing that is relatively fast to washing, and gives a material with a good handle. The addition of copper sulphate to the dressing gives the finished fabric a greater strength when exposed to continuous effects of light. C.

**Finishing Mixtures: Composition.** G. R. Kaulen. *Tekstil. Prom.*, 1941, No. 4, 38-40 (through *Chem. Zentr.*, 1942, ii, 2101 and *Chem. Abstr.*, 1944, 38, 2215<sup>5</sup>). Finishing recipes used in Russian plants were considered to be irrational. The Central Scientific Textile Institute undertook to work out a uniform recipe which should be appropriate, inexpensive and effective. It consists of calcium chloride, vegetable oil, animal glue, Turkey red oil, stearin, glycerol, starch, fats and water. Details are given in three tables. C.

**Rayon Fabrics: Finishing; Softness Test.** Lucille Sklut and Barbara Hazard. *Rayon Textile Monthly*, 1944, 25, 181-182. Instruments for measuring properties related to the softness of fabrics are described and evidence is given of the value of the Planoflex and the Friction Meter (Dreby, 1942). This evidence is given in two tables that record tests (averages of 8) on the handle of a 146×80 4 and 1 rayon twill finished by soaking in 1, 0.5 and 0.25 per cent. solutions of Onyxsan (a cationic imidazoline derivative), D.L.-1 (a cationic quaternary ammonium compound), Mapromol (a blend of oleyl alcohol and sulphated oleyl alcohol) and Velvosheen (a sulphated oil). The cationic agents gave the greatest flexibility but fatty alcohols had not much more effect than plain water. The cationic agents also produced the greatest surface slipperiness and here the fatty alcohols almost equalled them. Many of the sulphated oils had little effect on slip. C.

**Acrylic Resins: Use as Finishing Agents.** H. Lachmann. *Kleppzig's Textil-Z.*, 1941, 44, 874-876 and *Textilber.*, 1943, 24, 362-364 (through *Chem. Zentr.*, 1941; ii, 2393-2394 and *Chem. Abstr.*, 1944, 38, 2501<sup>7</sup>). The finishing of vegetable fibres, finishing and finishing agents, the studies by Staudinger and Röhm on the polymerisation products of acrylic and methacrylic acids and the polymerisation of the monomeric esters of these acids are discussed. The hardness of the Plexigum acrylic resins increases from Plexigum D in the order B, A, P, N and M. These products can be used for finishing in solution or as aqueous dispersions. C.

**Cellulose Fabrics: Etherification Finishing Treatments.** L. Bonnet. *Ind. textile*, 1940, 57, 219-220, 254-256 (through *Chem. Zentr.*, 1941, ii, 1345 and *Chem. Abstr.*, 1944, 38, 2501<sup>3</sup>). Surface esterification is accomplished by treatment with fatty acid chlorides, e.g. with the chloride of stearic acid in the presence of pyridine. Alkyl ethers of cellulose are obtained by the action of solutions of the chloromethyl ethers of the higher alkyls in pyridine. When the chloromethyl ethers are allowed to react with pyridine, valuable water-resistant products of the type of Velan are obtained. Alkali-celluloses can be etherified with ethylene oxide. C.

**Finishing Agents: Application.** R. Sansone. *Deut. Textilwirt.*, 1941, 8, No. 14, 18-20 (through *Chem. Zentr.*, 1941, ii, 3141 and *Chem. Abstr.*, 1944, 38, 2501<sup>6</sup>). The Appretans give full, washing and rubbing-fast finishing effects. Appretan EMW is suitable for staple fibre, wool, cotton and mixed fabrics containing staple fibre. The finish becomes more pliable on addition of Appretan A, B or Z; also Soromin DF and DM are effective, especially the latter, which produces fullness without stiffness. Appretan EM takes the place of starch and dextrin and gives cotton fabrics a particularly strong feel. Fixappret B in conjunction with starch or glue improves the washing fastness. Appretan SF is not suitable for combination with starch and the like. Other softeners are Ramasit I and III. A suitable addition agent to starch is Tylose TWA 100, which makes it possible to employ large amounts of fillers. Good lustres during calendering are produced by the use of I.G. wax J.W.I. For soft finishing effects Soromin A, WF, N, AS, BS and S are used. C.

**Spun Rayon Fabrics: Effect of Steam and Pressure.** F. Günther. *Kunstseide u. Zellwolle*, 1941, 23, 184-185 (through *Chem. Zentr.*, 1941, ii, 973 and *Chem. Abstr.*, 1944, 38, 2500<sup>6</sup>). Staple fibre, unlike wool, does not expand again after being compressed. In washing operations the rollers must be light in weight and should not press the fabric very tightly. The fulling cylinders must be light. Excessive pressures and weights must be avoided in all finishing operations, pressing, etc. For the manufacture of high quality mixture yarns only curled staple fibre that produces bulky yarn of high heat-insulating properties should be used. C.

#### (L)—PROOFING

**Chlorinated Paraffin Fire-, Water- and Mildew-proofing Agents: Application.** A. E. Irvine. *Amer. Dyes. Rept.*, 1944, 33, 189-192. Chlorinated paraffins (e.g. "Halowax") with Cl content 42-45 per cent. are now widely used as fire-proofing agents. Other products contain 60-70 per cent. Cl. Their action is ascribed to their ready decomposition with evolution of hydrogen chloride. This is promoted by the presence of metallic oxides, especially those of Fe, Zn and Sb. When applied to fabrics, some means must be provided to protect the fibre from acid tendering; usually the addition of calcium carbonate is effective. The products afford some protection against mildew, but in proofing a more effective agent (e.g. Cu naphthenate) is usually added. Pigments and film-forming agents (for waterproofing) are made up with the other ingredients in a volatile solvent. The mixture is applied by means of squeeze rollers or doctor knives, set to secure a take-up of about 50 per cent., and the cloth is then dried in air ovens or over cans. A suitable formula is (A) the non-volatile vehicle: chlorinated paraffin 22-24 per cent., resin 7-8; (B) the pigment, catalyst, protective and mildew-proofing ingredients: colouring matter 4-4.5, antimony oxide 7-8, iron oxide 8-9, antiseptic 1; (C) the volatile vehicle: 43-37 per cent. of light mineral oil, Stoddard solvent, xylene or other solvent. C.

**Gutta Percha, Balata and Polyethylene: Applications.** J. N. Dean. *Textile Manufacturer*, 1944, 70, 314-316. A broad review is given of the sources, production and properties of gutta percha, balata and polyethylene, and possible textile applications. Physical data are tabulated. C.

**Neoprene and Other Synthetic Rubbers: Textile Applications.** E. H. Krisman. *Amer. Dyes. Rept.*, 1944, 33, 246-251. A broad review of the history of natural and synthetic rubbers, with special reference to the properties of Neoprene and its uses in belting, roller coverings, vibrationless mountings for machines, and other textile fields. C.

**Nylon Fabric: Coating.** *Textile World*, 1944, 94, No. 4, 112-113. Practical hints are given, helped by illustrations, on the spreading of nylon fabric with plastic coatings. The difficulties are due to (1) the recurrence of tight and slack places across the cloth, particularly manifested by slack centres and baggy selvages, (2) yarn slip, (3) tendency to curl in the drying oven, and (4) static electrification. A good practise is to fix a backing fabric (e.g. heavy duck) to the front tension bar at one side of the doctor knife, weighted with the back tension bar hanging in a fold on the other side of the blade. A light sizing coat may be applied to reduce yarn slip. Springy spreading wires slightly wider than the cloth may be pinned to the selvages by their pointed ends to prevent curling and wrinkling of the cloth during drying. Where the cloth passes over a roller, a fringe of thin chains may be dangled to dissipate static charges. C.



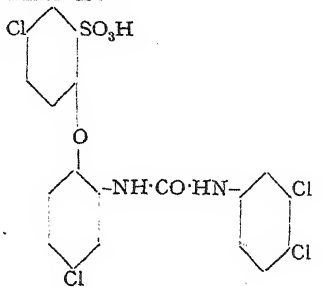
**Water-repellent Textile Materials: Behaviour of Water Drops.** A. Jaumann. *Kunstseide u. Zellwolle*, 1941, 23, 304-307 (through *Chem. Zentr.*, 1941, ii, 3141 and *Chem. Abstr.*, 1944, 38, 2215<sup>8</sup>). The behaviour of drops of water on different textiles, including some that were treated with water repellents, is shown by means of illustrations. Impregnations with Ramasit K conc. or with Persistol base + salt B did not allow the drops to penetrate even after prolonged standing. The double treatment of a velour chiffon of viscose rayon with the combination of Persistol and a Kaurit finish showed the fibres to have assumed the nap properties of silk. C.

**Spun Rayon Fabrics: Water-repellency and Swelling. Water-resistant Fabrics: Testing.** See Section 5C.

**Cotton Fabrics: Weather-proofing.** F. I. Sadov. *Legkaya Prom.*, 1940, 19, No. 11-12, 33-39 (through *Chem. Zentr.*, 1941, ii, 3014 and *Chem. Abstr.*, 1944, 38, 2500<sup>9</sup>). The extent of the loss of strength of cotton fabrics on exposure to the weather depends on the nature and the structure of the fabric, its chemical processing, the length of exposure, and the atmospheric conditions. The author recommends finishing treatments with (1) urea- or thiourea-formaldehyde resins, (2) copper sulphate hytosan finishing compound and (3) dicyanoformaldehyde resins. C.

**Rayon Fabrics: Rubberising.** — Kehren. *Textilberichte*, 1943, 24, 234-237, 274-277 (through *Chem. Abstr.*, 1944, 38, 2504<sup>5</sup>). The adhesion of the applied layer, the type of fibre from which the fabric was made, the nature of the rubberising, physical strength, and water extracts of rubberised goods are discussed. Simple curling-fast finishing and ordinary finishing for use in the tropics do not produce satisfactory results. Normal hydrophobing protects rayon only for a short time. A requisite for the service-ability of a rayon raincoat fabric is swelling-proof finishing, which must precede the water-repelling impregnation. The proper combination of suitable finishing and impregnation treatments can be determined only in large-scale tests. C.

**New Mothproofing Agents Containing Sulphonic Groups.** P. Langer. *Helv. Chim. Acta*, 1944, 27, 71-87 (through *J. Soc. Dyers & Col.*, 1944, 60, 190). The chemistry is discussed of mothproofing agents suitable for application by the methods used for dyes. These researches led to the discovery of Mitin FF (Geigy); the formula of which is:—



#### PATENTS

**Wool: Reducing Tendency to Felt and Shrink.** J. G. Mason, T. E. Thompson and Imperial Chemical Industries Ltd. B.P.561,475 of 22/5/1944. Wool and other animal fibres are treated, at any stage of manufacture or as garments, first in an aqueous solution of sodium chlorite and a wetting agent at <50° C., and then with hydrochloric acid at 90-95° C. To avoid discolouration, the mineral acid solution contains hydrogen peroxide, oxalic acid and/or tartaric acid. The material is finally bleached by immersion in an aqueous solution of sodium sulphite, sodium bisulphite, sodium hydrosulphite or sodium formaldehydesulphoxylate. Greatly reduced shrinkage properties are conferred, the tensile strength, elasticity and durability are not sensibly impaired, and the handle is only slightly inferior to that of untreated wool. W.

**Surgical Cotton Linting or Raising Machine.** C. Blair. B.P.562,287 of 22/1/1943:26/6/1944. A machine for linting or raising the pile on textile fabric, such as surgical lint or similar material, after the fabric has been bleached and made absorbent, consists essentially of a steel knife which is



moved to and fro over the flat surface of the fabric which passes from a roller over a tension bar and over a rubber pad beneath the knife-carrying bar, the fabric being drawn forward by a spiked roller. C.

**Water-sensitive Textile Materials: Production.** R. P. Roberts, E. B. Johnson and H. H. Taylor. B.P.562,386 of 27/11/1942:29/6/1944. A process for the manufacture of fabrics, yarns and other textile materials having a high degree of sensitivity towards water comprises treating a material having a basis of cellulose with an alkali and an etherifying agent so that the textile material retains its structure though the cellulose is converted into a cellulose ether which is capable of being swollen or dissolved by cold water. The treatment may also be applied to materials having a basis of a cellulose ester, especially cellulose acetate, the cellulose ester being both saponified and etherified in the course of the treatment. C.

**Photo-electric Cloth Length Measuring and Skew and Bow Correcting Apparatus.** British Thomson-Houston Co. Ltd. B.P.562,450 of 17/3/1943:3/7/1944 (Conv. 24/3/1942). Apparatus employed in the manufacture of material woven as a continuous strip comprising a series of similar sections separated by transverse portions having a light transmission characteristic which is materially different from that of those portions of the strip at opposite sides thereof, is provided with means for detecting variations in the length of the sections from a predetermined standard length comprising means for moving the strip longitudinally, means for causing a number of light beams to emanate from points of the strip spaced apart longitudinally thereof a distance equal to the standard length and means operative to give an indication in response to a time difference in the occurrence of corresponding variations in the light beams. Photo-electric devices may be arranged to receive the light beams and means responsive to a time difference in the output impulses of the photo-electric devices may be arranged to vary the relative speeds of strip moving means located at two longitudinally spaced points in order to adjust the lengths of successive strips. Means for correcting a departure from perpendicularity of the transverse portions or bands of the strip comprise further means engaging each side of the strip for moving it longitudinally, further means for producing light beams controlled by the passage of the transverse portions or bands of the strip and arranged on a line perpendicular to the strip and means responsive to a time difference in the occurrence of corresponding variations in the light beams for varying the relative speeds at which the two sides of the strip are moved. C.

**Nylon Crêpe Fabrics: Production.** British Nylon Spinners Ltd., G. Loasby and H. C. H. Talliss. B.P.562,555 of 7/12/1942:6/7/1944. Nylon fabrics showing crêpe and similar effects are produced by treating with a shrinking agent fabrics containing nylon threads that have previously been subjected to relatively mild treatment with formaldehyde, so that the various yarns in the fabrics will shrink by different amounts, the relatively mild treatment being such that the intrinsic viscosity of the treated threads can be restored to its original value by treatment with a dilute mineral or organic acid. Suitable shrinking agents include phenols, and formic, acetic, hydrochloric and sulphuric acids. After the treatment with a shrinking agent the fabrics may be treated with a dilute mineral or organic acid. The fabrics may contain in addition to formaldehyde-treated threads, untreated nylon threads and/or threads of other material, such as cellulose or silk. The shrinking treatment and/or the after-treatment with a dilute acid may be effected locally on the fabrics in order to produce novel pattern effects. Pleasing and novel pattern effects can also be obtained after dyeing the fabrics owing to differences in the dyeing affinities of the threads. C.

**Aqueous Synthetic Resin Dispersions: Preparation.** American Cyanamid Co. B.P.562,575 of 7/8/1941:7/7/1944 (Conv. 13/12/1940). A method of preparing stable aqueous dispersions of synthetic resins comprises preparing a liquid mixture of an alkyd resin having an acid number of 25 or more and an insoluble alkylated melamine-formaldehyde resin and adding to the mixture, with agitation, an aqueous solution of a proteinaceous emulsifying agent (e.g. ammonium caseinate) until an emulsion is produced. The proportion of alkyd resin may vary from 5 to 50 per cent. by weight. C.

**Alkali-soluble Carboxyethyl Cellulose Ether: Production.** Röhm & Haas Co. B.P.562,581 of 2/11/1942:7/7/1944 (Conv. 17/1/1942). A carboxyethyl cellulose ether that is insoluble in water but soluble in alkali is prepared by mixing within the temperature range 5° and 35° C., cellulose, a solution containing about 15 per cent. to about 40 per cent. of a strongly basic, insoluble hydroxide in an amount at least molecularly proportional to the glucose units of the cellulose, and about 0.2 to about 0.5 molecular proportions of acrylonitrile per glucose unit of the cellulose, until the reaction mixture is extensible with a 5 per cent. to 10 per cent. solution of a strong alkali hydroxide to form a substantially homogeneous solution or paste. C.

**Water-soluble Carboxyethyl Cellulose Ether: Production.** Röhm & Haas Co. B.P.562,584 of 5/11/1942:7/7/1944 (Conv. 17/1/1942). A water-soluble carboxyethyl cellulose ether is formed by reacting cellulose between 5° and 35° C. with an aqueous solution containing about 10-40 per cent. of a strongly basic soluble hydroxide and at least one molecular proportion of acrylonitrile per glucose unit of the cellulose, the amount of hydroxide being at least molecularly equivalent to the acrylonitrile reacting with the cellulose, until the reaction mixture is extensible with water to form a substantially homogeneous solution or paste even when acidified. C.

**Substantive Disazo Dyes: Production.** J. R. Geigy A.-G. (Basle, Switzerland). B.P.562,641 of 18/9/1942:11/7/1944 (Conv. 19/9/1941). Disazo dyes are obtained when 1 mol. each of a diazotised aminobenzene derivative with an *o*-positioned carboxyl group, but free from aroylamino groups, and of diazotised 6-chloro-2-amino-1-hydroxybenzene-4-sulphonic acid react in an alkaline solution with the condensation product from 2 mol. of 2-amino-5-hydroxynaphthalene-7-sulphonic acid with 1 mol. of phosgene or 1 mol. of cyanuric halide. In the latter case the third halogen atom, capable of reaction, may be replaced by an organic or inorganic residue, which latter does not take any active part in the dye formation, such for example as NH<sub>2</sub> or NHPh. The dyes can be coppered in the usual manner. As the diazotised amino benzene derivative, with *o*-positioned carboxyl group, but free from aroylamino groups, 2-aminobenzoic acid, or its substitution products such as 5-chloro-2-aminobenzoic acid or 5-nitro-2-aminobenzoic acid, may be used. Examples are given of the production of coppered dyes which give light-fast bluish red and Bordeaux shades on cellulose fibres. C.

**Diarylpyrrole Azo Dyes: Production.** M. Mendoza, M. A. T. Rogers and Imperial Chemical Industries Ltd. B.P.562,762 of 13/7/1942:14/7/1944. Azo dyes are made by coupling a diazotised arylamine with a 2,4-diarylpyrrole which may or may not be substituted in the 3-position. The dyes, especially those from arylamines containing in an ortho-position to the amino group a group which is reactive to metals, e.g. a carboxy or hydroxy group or a group convertible thereto, may be metallised. Acid wool dyes and direct cotton dyes of various shades, e.g. orange, brown, reddish brown and blue, can be obtained, which are of good fastness, particularly in the case of the metallised dyes. C.

**Crease-resisting Cellulose Textile Materials: Production.** Courtaulds Ltd. and J. Boulton. B.P.562,790 of 21/12/1942:17/7/1944. A process for the production of cellulosic textile materials having improved crease-resisting properties comprises impregnating the materials with a solution containing formaldehyde and urea or thiourea, either as such or in the form of their water-soluble intermediate product, together with an acid catalyst consisting of a mixture of boric acid and an aliphatic hydroxycarboxylic acid, such as tartaric or lactic acid, and thereafter subjecting the treated material to the action of heat to convert the formaldehyde and urea or thiourea or the water-soluble intermediate product into an insoluble condensation product. C.

**Fabric Embellishing, Conditioning and Processing Machine.** P. Shiel. B.P.562,937 of 2/3/1943:21/7/1944. A machine for embellishing, conditioning or processing fabrics comprises means for supporting the fabric between obstructions so that liquid, gaseous, or solid agents sprayed from nozzles past the obstructions or through apertures in the same produce some form of shape, edge, stencil, shadow, silhouette, spot, line or other aspect of the obstructions on both sides of the fabric. The effects obtained may be varied by varying the agents and the obstructions, and by altering the angle of diffusion, pressure and

position of the nozzles, maintaining the fabric at rest or imparting a continuous movement to it, and varying other conditions. C.

**Wool: Reducing Tendency to Felt and Shrink.** American Cyanamid Co. B.P. 562,977 of 25/7/1944. Wool or wool-containing fabrics are impregnated with a dispersion or solution of an alkylated methylol-melamine containing a catalyst. The material is then dried and cured at 200-300° F. Details are given of the shrink-resisting qualities imparted to a light-weight woollen flannel. Almost complete control of shrinkage may be had by using long curing periods and high temperatures. The shade of dyed wool and its fastness to light are unaffected, and the tensile strength of the wool is increased. W.

**Fabrics: Identification Marking.** National Marking Machine Co. Ltd. B.P. 563,098 of 16/4/1943:28/7/1944. (Conv. 11/5/1942). In a method of applying identification marks to fabrics, a thin sheet of rubber or like material capable of flowing under heat and pressure is interposed between the fabric and heated type which is pressed so that the material immediately adjacent the type face is separated from the sheet and forced into the fabric, the remainder of the sheet being finally removed. A sheet of tough flexible material, e.g. Cellophane, is preferably interposed between the heated type and the sheet of flowable material and secured to the latter. The rubber is coloured to contrast with the colour of the fabric. Identification marks applied in this way will withstand severe laundering, kier boiling, and other severe cleaning operations. C.

**Cellulose Derivative Fabrics: Anti-shrinkage Treatment.** C. Dreyfus. U.S.P. 2,337,652. Fabrics containing cellulose derivative yarns are scoured at 80° C. in an aqueous solution containing 60-90 gms. per l. of a neutral salt that inhibits swelling and a dispersing agent, and dyed in a bath containing a large amount of the same salt. The tendency of the fabric to shrink when wetted and dried is thereby minimized. C.

**Wool: Reducing Tendency to Felt and Shrink.** Prestige Ltd. Australian P. 117,933 of 17/12/1943. The desirable characteristics of wool are retained, and its felting properties largely eliminated, by acid halogenation under controlled conditions and in the presence of a substance, e.g. an aldehyde or soluble alcohol, which reduces the oxidation potential of the solution and lowers its pH value over the period of the reaction. The treatment plasticises the wool scales which are caused to adhere to the fibres. W.

**Wool: Reducing Tendency to Shrink and Felt.** Holeproof Ltd. Australian P. 118,223 of 2/3/1944. The wool is treated in a solution comprising an organic liquid (70-90 per cent. by weight of a monohydric aliphatic alcohol containing 2-5 carbon atoms), an inorganic or organic hydroxide dissolved in the liquid, and a polyhydric alcohol (glycerol or ethylene glycol) present in a concentration of not less than 5 per cent. by weight of the solution. The solution modifies the gelatinising effect of the alkaline substance, so that the original handle of the wool is substantially retained. W.

**Keratin-containing Materials; Protection from Pests.** W. Müller and W. Retter (to I.G. Farbenind. A.-G.). D.R.P. 716,599 of 24/12/1941 (through *Chem. Abs.*, 1944, 38, 2512). Dipyrzolonylphenylmethane compounds containing no amino, substituted amino or sulpho groups are used as the protecting substance. W.

**Mothproofing Fibres.** K. Brodersen and M. Quaedvlieg (to I.G. Farbenind. A.-G.). D.R.P. 735,092 of 1/4/1943 (through *Chem. Abs.*, 1944, 38, 1382). Heavy metal salts, preferably copper salts, of trithiocarbonic acid ( $\text{H}_2\text{CS}_3$ ) or its analogues with higher sulphur content are precipitated on the fibres. W.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Cellulose Hydrate Fibres: Structure.** H. Siebourg. *Zellwolle, Kunstseide, Seide*, 1941, 46, 215-223 (through *Chem. Zentr.*, 1941, ii, 1463 and *Chem. Abstr.*, 1944, 38, 2198<sup>3</sup>). The properties of artificial fibres are to be attributed not only to the degree of polymerization of the original cellulose and the X-ray orientation, but also to their internal structure. In order to gain some insight into the principles by which the various fibres are built up, studies were made of the rates of acetylation and solution of such fibres by treating them for about

10 min. with a 1:1 mixture of acetic acid and acetic anhydride after preliminary soaking. Examination of cross-sections of the fibres under the microscope revealed that, in most viscose rayons, the interior of the fibre was dissolved first, after which the surrounding external layers disintegrated. When an insufficient amount of the anhydride was used, only a very marked swelling was observed. Since it is impossible to reproduce the rate of solution of fibres to the second, it is recommended that a reference fibre previously dyed with Korinth RK or Brilliant Violet BBK be introduced with each test. Comparison of two fibres of the same origin showed that the fibre which was more resistant to wetting also withstood solution longer. With Schwarza and Lanusa fibres the solution process attacked all portions of the fibre cross-section simultaneously. Cuprama fibre behaved in a similar manner. Comparison of viscose fibres from 5, 7 and 10 per cent. solutions showed that fibres spun from the most dilute viscose dissolved first; fibres from the 7 and 10 per cent. solutions showed no difference in this respect. Of fibres stretched to various degrees, those which were stretched least dissolved first. C.

**Cotton-Viscose Rayon Mixtures: Quantitative Analysis.** F. P. Greenspan and S. M. Edelstein. *Amer. Dyes. Rept.*, 1943, 32, 73-76, 98. Work on a large number of viscose rayon samples from various sources showed that the ratio of the barium hydroxide adsorbed by viscose rayon to that adsorbed by a standard cotton yarn under identical conditions was fairly constant. This adsorption ratio when obtained under a particular standardised set of conditions and multiplied by 100 is known as the Barium Activity Number. Since the adsorption varies with the equilibrium concentration, the Barium Activity Numbers are corrected to the same final equilibrium concentration of barium hydroxide and then designated "Hydroxide Adsorption Numbers." All viscose rayons give the number 348 with a negligible error whereas unmercerised cottons give the number 100. For the analysis of mixtures, the Hydroxide Adsorption Number of the unknown sample is determined and the percentage of each fibre is calculated from this result and the numbers 100 and 348. Details of the experimental procedure and calculations are given. Analyses of various known mixtures by this method indicate good results, within the accuracy desired for mill and testing laboratory work. The greatest error is found with mixtures containing a large percentage of rayon. The procedure with the constants as given is applicable to mixtures containing unmercerised cotton, but not to mixtures containing mercerised cotton, which has a Hydroxide Adsorption Number of 100-165 according to the degree of mercerisation. It can, however, also be used for the analysis of linen-rayon mixtures since linen has a Hydroxide Adsorption Number of 100. In mixtures of rayon and cotton containing also wool, or silk, or both, the silk and wool may be removed by treatment with hot 5 per cent. caustic potash or soda, and the residue analysed as above, since the caustic treatment does not affect the Hydroxide Adsorption Numbers of rayon and cotton. C.

**Rayon: Alkali Solubility; Determination.** E. Kühnel. *Kunstseide u. Zellwolle*, 1941, 23, 235-242 (through *Chem. Zentr.*, 1941, ii, 2157 and *Chem. Abstr.*, 1944, 38, 2216<sup>4</sup>). A critical review of the usual methods of determining alkali solubility showed that they had no relation to the behaviour of the fibres in wash liquors and were, besides, exposed to numerous sources of error. A new method is to treat the fibres for 1 hour at 20° with a 10 per cent. solution of caustic soda, centrifuge, wash twice more with 10 per cent. caustic soda then with saturated sodium sulphate solution, make acid with acetic acid, wash with water, dry and weigh. But even the 10 per cent. concentration of caustic soda showed no relation to the solubility characteristics of different fibres. Further experiments showed the unsuitability of caustic soda solutions even at lower concentrations. Good results were obtained by boiling 1 hour under the reflux condenser with 0.2 per cent. sodium carbonate solution. The fibre residue was filtered and an aliquot portion titrated with 0.1N permanganate to a rose colour. The factor (obtained with glucose) is 2.27; c.c. 0.1N permanganate  $\times$  2.27 = per cent. soluble ingredients. Repeated boiling tests on the same sample showed that intermediate drying increased the solubility. Practical washing and wearing tests showed good agreement with the new method. C.

**Flax Cellulose: Fluidity Determinations.** W. A. S. White and T. N. Richardson. *J. Textile Inst.*, 1944, 35, T53-60. C.

**Fibres: Moisture Absorption.** W. Bobeth. *Kleppzig's Textil-Z.*, 1941, 44, 975-982 (through *Chem. Zentr.*, 1941, ii, 3144 and *Chem. Abstr.*, 1944, 38, 2212<sup>b</sup>). Experimental work is described and results are given for average moisture absorption at 65 per cent. R.H. for various fibres. These values are recommended to take the place of standard regains in calculations of quantitative chemical analyses of mixture fabrics. C.

**Fibres: Structure.** G. Vogt. *Kunstseide u. Zellwolle*, 1942, 24, 404-412 (through *Chem. Zentr.*, 1942, ii, 2865 and *Chem. Abstr.*, 1944, 38, 2211<sup>b</sup>). Layers, fibrillae, chain molecules, micelles and atoms in the construction of natural fibres are described. The influence of the layers of fibrillae on the technical properties of fibres are discussed. Artificial fibres do not need to be exactly the same as natural fibres in all details of structure, but it appears to be necessary to realise the fibrillar structure in some form. C.

**Cellulose: Chemical Constitution and Physical Properties.** G. Dierkes. *Kunstseide u. Zellwolle*, 1941, 23, 243-248; *Deut. Wollen-Gewerbe*, 1941, 73, 857-862 (through *Chem. Zentr.*, 1941, ii, 3015 and *Chem. Abstr.*, 1944, 38, 2483<sup>b</sup>). The author attempts to correlate the chemical constitution of cellulose with a series of physical properties of cotton, staple fibre and filament rayon, such as tearing strength, stretchability, swelling tendency, lustre and viscosity. C.

**Cotton Linters: Degradation; Determination.** R. Béha. *Ind. textile*, 1941, 58, 335-336 (through *Chem. Zentr.*, 1941, ii, 2275 and *Chem. Abstr.*, 1944, 38, 2486<sup>b</sup>). Methods are described for determining  $\alpha$ -cellulose, copper number, methylene blue absorption and alkali solubility. A high consumption of methylene blue occurs with a large content of lignified fibres; raw cotton has a high methylene blue number. Markedly degraded fibres show a high alkali solubility. There is a direct relationship between the copper number and the  $\alpha$ -cellulose content. C.

**Damp Stored Cotton: Deterioration.** C. Nanjundayya. *Indian Textile J.*, 1944, 54, 309-312. The author stored samples of Surat 1027 A.L.F. cotton, raw, hand picked, solvent-extracted (de-waxed) and scoured (de-pectinized), under sterile conditions over brine at  $33.5 \pm .5^\circ$  C. (=97 per cent. R.H.) for periods up to 4 months and measured their fibre-bundle strength, fluidity, copper number and moisture content. The results are tabulated and treated by the analysis of variance. The raw cotton suffered a considerable loss in strength and copper number, but little increase in fluidity. The de-waxed and de-pectinized samples suffered a fall in copper number, but the other characters were not much affected. The moisture content of the raw cotton progressively increased in storage. It appears that the non-cellulosic constituents undergo a change that affects the copper number and moisture content but not the fluidity. C.

**Fibre Identification Stains: Effect of Textile Finishes.** B. Norwick. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 274. Finishing treatments produce changes in the colours shown by rayon fibres on treatment with stains. When the nature of the fibre is known, anomalous dyeing may serve to determine the finish or the extent of processing. A table is given showing the colours given by acetate and viscose rayon materials with the Davis and Rynkiewicz stain after caustic treatments at different concentrations and temperatures. Tables are also given showing the possible significance of various colours produced with this stain and the colours given by various sizing materials. Cotton, dried with formaldehyde and a trace of acid, moistened with ammonia, and then heated either in an oven or in an organic liquid such as lauryl alcohol, quickly loses its ability to pick up blue from the stain and shows first reddish shades and then yellows. Drying cotton with glyoxal gives similar results. The presence of melamine on cotton causes the latter to pick up yellow. Drying viscose with glyoxal yields a yarn which dyes a pale yellow. The common creaseproof and shrink-resisting urea-formaldehyde finish gives yellow shades. Incomplete and uneven desizing can be rapidly detected on known fabrics of nylon, viscose and acetate rayon, since the common size materials stain a deep, contrasting blue. C.

**High-polymer Filaments: Structure.** F. H. Müller. *Forsch.-Ber. Zellwolle-u. Kunstseide-Rings G.m.b.H.*, 1942, No. 1, 65-69 (through *Chem. Zentr.*, 1942, ii, 2102-2103 and *Chem. Abstr.*, 1944, 38, 2498<sup>a</sup>). High-polymer products contain-

ing fibrous molecules are assumed to contain molecular nets and felt-like structures, but no micelles or crystallites. The arrangement of the netting-like structure is characterised by a function which indicates the distribution of the monomeric residues in their steric orientation. A state of orientation is considered to be a static equilibrium between orientating tendencies and temperature movement. The spinning process is discussed on the basis of these studies. C.

**Insulating Silk: Testing.** Y. N. van-Haut. *Shelk*, 1940, 10, No. 11, 21-23 (through *Chem. Zentr.*, 1941, i, 3606 and *Chem. Abstr.*, 1944, 38, 2499<sup>6</sup>). The conductivity and acidity of aqueous extracts of several grades of dyed silk, their hygroscopic properties, ash contents, and the insulating resistance of cables at 80 per cent. relative humidity were studied. Specific resistance of aqueous extracts at 20° should not be below 25,000 ohms/cm. (Extract 2 g. of silk at 96-97° for 2 hours using a reflux condenser, with 80 c.c. of water, and determine the conductivity with the Coulé or Kohlrausch bridge). The moisture content at 80 per cent. R.H. should not exceed 11.5 per cent. The time for the moistening of the sample according to a standard procedure should not be less than 4 days. No mineral acids should be present. The amount of organic acids calculated as acetic acid should not exceed 0.02 per cent. To determine these, extract with a reflux condenser at 100° for 2 hours or at 45° for 30 min. (provisional standard), and titrate potentiometrically. C.

**Silk: Effect of Electrolytes on Electrical Conductivity.** G. R. Vishnevetskii. *Legkaya Prom.*, 1940, 19, No. 11-12, 44-47 (through *Chem. Zentr.*, 1941, ii, 3014 and *Chem. Abstr.*, 1944, 38, 2498<sup>7</sup>). The introduction of electrolyte into silk fibre by treatment with N.-sodium sulphate solution has the same effect on the electrical conductivity of the fibre as does an increase of atmospheric humidity by 15 per cent. Sodium chloride has a still greater effect on the conductivity of silk. Silk treated with sodium chloride has the same conductivity at 40 per cent. R.H. as untreated silk at 70 per cent. R.H. C.

**Spruce Processionary Caterpillar Silk: Characteristics.** G. Gallese. *Textilia* (Milan), 1940, 16, 495-496 (through *Chem. Zentr.*, 1941, i, 3605-3606 and *Chem. Abstr.*, 1944, 38, 2499<sup>4</sup>). The fibre of the cocoon of *Thaumetopoea processionea* has a silk-like lustre, is gray to yellowish, and is microscopically similar to the bombyx fibre. Its average tensile strength is 1.95. It is soluble in water at 120° and water at 45° dissolves 11.25 per cent. after 12 hours; the solution is chestnut brown, is faintly acid, contains 10.05 per cent. of dry material (120°) and yields 1.75 per cent. ash. Boiling with water for 1 hour dissolves 22-34 per cent. of the fibre. The fibre is soluble in cold caustic soda, warm soda solution and soap solution. Zinc chloride first turns it brown and then dissolves it. The fibre cannot be used as a textile raw material but may possibly be employed as a substitute for kapok. C.

**Animal Fibres: Identification in Medico-legal Cases.** J. L. Stoves. *Medico-legal and Criminological Rev.*, 1943, 11, 185-191. Examples are given showing the importance of fibre histology in forensic science. Methods of identification are described for various non-human mammalian hairs, preliminary examination being microscopic and chemical, and histological examination involving the study of transverse and longitudinal sections and of superficial scale structure. Typical results are illustrated by photomicrographs. W.

**Australian Merino Wool: Crimp-fineness Relationship.** W. R. Lang. *Pastoral Rev.*, 1944, 54, 78-79. The Gordon Institute of Technology, Geelong, Vic., has surveyed 1,373 staples, representing a very fair cross-section of the Australian merino clip. Each sample was measured under the micro-projector at x/350, and the mean thickness calculated from 250 observations. The quality number was allotted from Duerden's quality number-thickness scale for S. African wools, and the number of crimps per in. compared with his crimp-quality scale (this *Journal*, 1929, 20, T93). The analysis of the results as compared with those of Bosman (this *J.*, 1937, 28, P270) showed that Australian merino wools had a closer crimp-fineness relationship (28 per cent. agreement) than S. African (16 per cent. agreement). W.

**Wool Yields from Four Breeds of Sheep.** E. M. Pohle and L. N. Hazel. *J. Animal Sci.*, 1944, 3, 159-165. Clean wool yields of whole fleeces and of small samples from 8 body regions were compared, the breeds used being the Rambouillet, Targhee, Corriedale and Columbia. The average yields were highest

from the shoulder, hip, thigh and belly for all 4 breeds, and lowest from the withers, back, rump and side for most of the 4 breeds. The average yield of the whole fleece for the 4 breeds was 38.6 per cent. There was a highly significant difference of 3.4 per cent. between the average small sample and whole fleece yield, breed differences and differences among sheep within the breed also being highly significant. The most accurate coefficients for predicting whole fleece yields appeared to be the *a* and *b* values for a particular region averaged for the 4 breeds. The withers, back and rump were the least desirable regions for taking small samples, the differences in accuracy among the other regions being so small that choice may be decided by ease of sampling. W.

**Shrinkage and Value by Grades for 1943 Range Wools.** E. M. Pohle and H. R. Keller. *Sheep & Goat Raiser*, 1944, 24, No. 8, 8-10. The 1943 wool clip of the U.S. Sheep Experiment Station and Western Sheep Breeding Laboratory, Dubois, Idaho, was graded at shearing and scoured in a commercial plant, and the wool was then appraised and sold on a scoured, sorted basis. Data are given on the shrinkage and appraisal values from 3,482 fleeces produced by the Rambouillet, Targhee, Corriedale and Columbia breeds. W.

**Wool: Determining Shrinkage.** J. V. Christensen and A. C. Esplin. *Farm and Home Sci.*, 1943, 5, No. 4, 5, 11 (through *Exper. Sta. Rec.*, 1944, 90, 716). Composite sampling for flocks of sheep and side sampling for individual, particularly purebred, sheep, with subsequent wool shrinkage studies, showed the need for sampling clips of each grower to determine a fair market price for wool, and also showed that breeding stock should be selected for length of staple as well as weight of fleece. Tables show (1) range in shrinkage of wool from samples from 25 flocks by grades; (2) variation in grease weight, scoured weight, staple length and shrinkage in 373 sheep from 4 pure-breed flocks of Rambouillets; (3) comparison in production based on staple length. W.

**Fleeces of Navajo Sheep: Preliminary Report on the Post-natal Development of Fibre Characteristics.** J. O. Grandstaff and C. T. Blunn. *J. Animal Sci.*, 1944, 3, 194-200. Samples from the side, thigh and back of 15 Navajo ewe lambs were measured, at intervals of 28 days to one year of age, for percentages of wool, hair and kemp, and the diameter distributions determined. At 28 days the samples averaged 60 per cent. wool, 24 per cent. hair and 15 per cent. kemp; during the next 56 days wool increased 21 per cent. and hair and kemp decreased 9.5 and 10.5 per cent. respectively; from 84 to 364 days the proportions of the 3 types remained relatively constant. The diameter distributions for wool and hair did not change significantly during the year, but kemp showed a significant change in distribution between the 28 and 56 day samples. W.

#### (B)—YARNS

**Silk Yarns and Fabrics: Analysis for Acids and Chlorides.** G. Baroni. *Seta*, 1941, 47, 127-129 (through *Chem. Zentr.*, 1941, ii, 2637 and *Chem. Abstr.*, 1944, 38, 2213<sup>8</sup>). The total acids were determined by titration of an aqueous extract of 10 g. of yarn or fabric with 0.1N. caustic soda using phenolphthalein as indicator. The results were expressed as sulphuric acid per 100 g. of dry material. To determine the free sulphuric acid separately a 50-g. sample was repeatedly extracted with lukewarm water and the combined extracts were evaporated to about 10 c.c. Two c.c. of this solution were placed on a 7-cm. filter paper, which was then dried at 100°. If the paper darkened or became brittle, the presence of free acids ( $\text{HCl} + \text{H}_2\text{SO}_4$ ) was indicated. The remainder of the concentrated solution was evaporated in a platinum dish and dried for 2 hours at 150°. The residue was sulphuric acid. In order to determine hydrochloric acid quantitatively the extract of a 50-g. sample of yarn or fabric was distilled with steam and the hydrochloric acid titrated in the distillate. In the absence of free sulphuric acid, chlorides could be determined directly with silver nitrate in the residue from the steam distillation. Otherwise, chlorides were determined as free hydrochloric acid after distillation with steam. C.

**Yarn Calculation Tables.** E. Whitworth. *Textile World*, 1944, 94, No. 4, 102-103. The following "ready reckoner" tables are provided: (1) Number of yards per lb. of worsted yarn ranging in counts from 1 to 99. (2) Ditto for cotton, counts 1-120. (3) Deniers equivalent to skein lengths of 100, 120, 200 and 300 yards and weights ranging from 1 to 9 grains. C.



## (C)—FABRICS

**Dial-reading Steelyard-type Strength Testing Machine.** S. Denison & Son Ltd. *Textile Manufacturer*, 1944, 70, 304-305. A detailed, illustrated description is given of a testing machine that can be fitted with jaws for cloth, webbing, tapes, cord, etc., and is constructed in the range of 600, 2,500, 5,000 and 8,000 lb. capacity. The top jaw is connected by knife-edge levers and links to a steelyard which is also linked to a dial pointer that indicates the load directly. Pull on the other jaw is effected through hydraulic gear which may be worked from the water main for the lightest models or through a motor-driven oil pump with constant or adjustable piston. Constant rate of load mechanism (B.P.560,832) comprises a trolley having rear wheels that run on fixed rails and a front wheel that rests on the steelyard. The trolley is motor driven so as to keep the steelyard floating. The knife edge of the steelyard can be adjusted so that the machine capacity can be made one-half, one-fifth or one-tenth the full capacity. The dial is divided into 600, 500 or 800 divisions. That for the 8,000-lb. machine has 800 divisions, so that each division means 10, 5, 2 or 1 lb., according to the knife-edge setting. The machine can also function as a constant rate of traverse type by adjusting the hydraulic pump gear. An autographic load/extension recorder with load ordinate vertical can also be fitted. C.

**Light-weight Fabrics Compression Meter.** E. C. Dreby. *Amer. Dyes. Rept.*, 1944, 33, 199-204. A description is given of an instrument for testing the compressibility of soft, light-weight fabrics under pressures between 0.05 and 0.50 lb. per sq. in. The main part is a metal cylinder with a conical cavity, the base of which is closed by a rubber membrane, 3 in. diameter and 0.004 in. thick. This part is hinged at one point and can be brought down on the fabric, which is clamped in a ring over a base plate. The cavity is filled with an 8 per cent. solution of potassium dichromate which rises at the apex of the cone into a graduated glass capillary tube (about 1 mm. bore). The top of this tube is fitted with a needle valve. The cavity is filled through a well to one side of the central tube. Opposite this opening is another well closed by a micrometer screw, the stem of which (0.25 in. diam.) acts as a piston to make a fine adjustment of the air pressure on the liquid and therefore of the height of the column in the capillary tube. This tube is graduated in units of 0.05 lb. per sq. inch by clamping a pan to the base of the instrument and connecting it through a side tube to a vertical glass tube in which known heads of water can be established. Tests on fabrics are made at a controlled temperature, since a fluctuation of 5° F. would introduce an error of 10 per cent. or more. To make a test, the needle valve is opened and the micrometer is turned until the level in the capillary is raised to the lowest graduation. Half a minute is allowed for the system to establish itself and the micrometer is then adjusted to get the liquid in the capillary on the mark. The micrometer setting is read and the liquid in the capillary is then brought to the other graduations in succession, up to the top and down again, and the corresponding micrometer settings are noted. The compressibility of the fabric is given by the equation

$$\text{compressibility} = \frac{a(R_1 - R_2) - V}{A.T.M. (P_2 - P_1)}$$

where  $R_1$  and  $R_2$  are the micrometer readings at pressures  $P_1$  and  $P_2$ ,  $V$  is the volume of liquid in the capillary equivalent to  $(P_2 - P_1)$ ,  $a$  is the area of cross-section of the micrometer stem,  $A$  the area of fabric covered by the rubber membrane,  $T$  the thickness of the fabric measured by an ordinary dial gauge instrument under a pressure of 1 lb. per sq. in., and  $M$  is a constant (the units are inches, sq. in., cub. in., and lb., according to the context). For comparisons, however, as in the ranking of a series of fabrics according to "handle," the simple difference in micrometer readings between the values for 0.05 and 0.45 lb. per sq. in. may be used; this is called the "compression meter value." Results are recorded for a series of 80 × 80 cotton percales, arranged in order of "fullness" as judged by trained men, and for a set of four cotton fabrics, 100 × 56, and two spun rayon fabrics. The relationship of the compression measurements to flexibility tests by the "Planoflex" is indicated in the tables. C.



**Cellulose Materials: Determination of Degree of Damage.** (1) O. Eisenhut. (2) H. Vetter. *Textilberichte*, 1941, 22, 424-426; 426-428 (through *Chem. Zentr.*, 1941, ii, 2274 and *Chem. Abstr.*, 1944, 38, 2212<sup>7</sup>). (1) The most accurate method for determining the damage to fibres by chemical agents is the observation of the change in the average degree of polymerization. A formula for determining the damage factor is developed and a table shows the damage to cotton produced by different treatments, such as bleaching, hydrolysis and washing. By this method it is possible to express numerically any kind of chemical damage to cellulose and thus to compare the method of action of such processes. (2) Nomograms are given for quickly and accurately determining the degree of damage of fibrous materials. C.

**Moist Knitted Underwear Fabrics: Thermal Properties.** C. W. Hock, A. M. Sookne and M. Harris. *Amer. Dyes. Rept.*, 1944, 33, 206-219. It is generally recognized that fabrics of comparable thicknesses and densities do not vary much in thermal resistance, but that moist fabrics vary considerably in the extent to which they create a "clammy feel" in contact with the skin. This property has now been investigated on a series of knitted underwear fabrics, particulars of which are tabulated. They include cotton, wool, cotton/wool mixtures, and pure viscose, acetate and nylon rayon fabrics. The particulars include measurements on twice-laundered materials, of weight, thickness under 0.1 lb. per sq. in. pressure, air permeability (Schiefer and Boyland instrument) and thermal transmission (Cleveland instrument). Three types of test are reported. (1) *Subjective tests*. Fabrics containing 100, 150 and 200 per cent. of moisture (based on the conditioned weights) were compared in pairs, one on each forearm, by five men, in a room at 21.1°C. and 65 per cent. R.H. The initial impression of chill and of a difference between the two arms was recorded. (2) *Physical tests*. An apparatus is described in which the upper half of an oil bath, maintained at  $50 \pm 0.05^\circ\text{C}$ . was covered by asbestos sheeting and a layer of rubberized cloth on which were laid four copper-constantan thermal couples, the whole forming a "skin"  $\frac{3}{8}$ -in. thick, the surface temperature of which (mean of the four thermo-couples) remained at  $37.5^\circ\text{C}$ . when exposed to the draught created by a fan blowing air over a water-cooled radiator. Specimens of the cloths,  $3\frac{1}{2} \times 6$  ins., were wetted and squeezed out until they contained 150 per cent. of moisture, and then laid over the "skin" and held in position under strips of cheesecloth having weights of 0.3 lb. hanging from each end. The changes in "skin" temperature were observed at intervals from 30 seconds to 10 minutes. Results are given in a series of eight graphs. (3) *Contact tests*. To assess the closeness of contact between the fabric and the "skin," a soft paper (particulars given) was prepared by steeping in the colourless suspension obtained by grinding basic fuchsin and rubber in Stoddard solvent. The dry paper ( $3\frac{1}{2}$  ins. square) was laid on a glass plate, covered with the moist fabric and another glass plate, and weighted to make the pressure of contact equivalent to 0.5 lb. per sq. in. After 10 minutes the paper was inspected and measured photometrically to give a figure for the colour developed by contact with the moist fabric. Photographs of the papers are reproduced for all the cloths, containing 200 per cent. of moisture, and a series of eight graphs show per cent. reflectances plotted against per cent. moisture (up to 400 per cent.). The main conclusion drawn from the investigation is that the "chilling effect" is directly connected with the closeness of contact. The advantage of wool lies in its natural ability to minimise this and the chilling effect of wet cotton fabrics can be lessened appreciably by giving them a napped or fuzzy surface. C.

**Spun Rayon Fabrics: Water Repellency and Swelling.** A. Zart. *Zellwolle, Kunstseide, Seide*, 1941, 46, 180-182 (through *Chem. Zentr.*, 1941, ii, 1463-1464 and *Chem. Abstr.*, 1944, 38, 2215<sup>9</sup>). In order to measure the water repellency of chemically treated spun rayon fabrics the pressure necessary to force water through a definite thickness of the material was determined. Disks of the material were securely fastened between nickel screens, and water pressure on the under surface was slowly and uniformly increased by raising a levelling bulb until water just appeared on the upper surface. This point was taken as the reading. The pressure required at first increased with increasing weight of the material and then remained constant beyond a definite weight. It was necessary to avoid reverse changes in pressure. The recorded pressure was independent

of the time during which it was applied. It was necessary to keep the effective surface of the disk, the weight of the material and the rate of uniform increase in pressure as constant as possible. With increasing titer the water repellency and the effective surface, calculated on the same weight of material, decreased. Treatment with boiling soap-soda washing solutions only slightly decreased the water repellency. Treatment with formaldehyde produced a very sharp reduction in swelling, but only very slight ability to repel water. Swelling values and water repellency are reported in tables. It is advisable to discontinue use of the term "hydrophobic" in this connection. C.

**Water-resistant Fabrics: Testing.** G. A. Slowinske. *Amer. Dyes. Rep.*, 1943, 32, 85-91. Measurements were made with a hydrostatic pressure tester, an air permeability tester (a commercial Densometer), and a new impact penetration tester in which the fabric is placed over an absorbent blotter and subjected to a spray of water, the amount of water passing through being determined by weighing the blotter. Photographs of the three instruments and diagrams showing details of the impact penetration tester are given. Measurements are recorded on 50 cotton fabrics which had been processed under the same conditions with the same concentration of a commercial water repellent and were rated "100" in the spray test of the American Association of Textile Chemists and Colorists. It is assumed that the results obtained in the impact penetration and hydrostatic pressure tests on these fabrics are related to the effects of fabric construction. No real relationship appears to exist between the results obtained with the three instruments. Results obtained for series of poplins and twills, suggest that the data in the three tests are inter-related for a single weave of fabric, and that when one weave is considered it is possible to predict the relative performance of a water-resistant fabric, even before it is treated, from the air permeability of the untreated fabric, since water-repellents do not change the air permeability to any appreciable degree. Hydrostatic pressure data for a number of twills treated with two different water repellents show that the order of performance is the same with the two products. Other work has shown that the same relationship holds for fabrics of different weaves treated with different water repellents. This makes it possible to choose a fabric for use in, e.g. a raincoat, without first deciding what water repellent will be specified. For evaluating or predicting the performance of a water-resistant fabric intended for use in garments subjected to outdoor wear it is necessary to consider (1) resistance to wetting of the fibres and yarns, (2) resistance to the passage of water under static pressure, and (3) resistance to the passage of water under impact or dynamic pressure. Resistance to the passage of air should also be considered if the fabric is intended for use in a wind-resistant garment. The A.A.T.C.C. spray and immersion tests are well suited for evaluating (1), and the hydrostatic pressure and impact penetration testers for (2) and (3). It is believed that the hydrostatic pressure test and the impact penetration test could be used together to grade water-resistant fabrics intended for use in rain wear, and a suitable grading system is suggested. C.

**Rayon Fabrics: Finishing; Softness Test.** See Section 4H.

**Filtering Fabrics: Stability** O. R. Herfurth. *Deut. Wollen-Gewerbe*, 1942, 74, 461-466 (through *Chem. Zentr.*, 1942, ii, 2065 and *Chem. Abstr.*, 1944, 38, 2237<sup>4</sup>). A discussion of the action of water, acids and alkalis on the filtering medium, dry filtration, filtration temperature, and the nature of the weave and thickness of the fabric. The mechanical stress caused by the filtering pressure is discussed. None of the various impregnations tried has made it possible to produce a good, long-lasting filtering medium from staple fibre for wet filtration. The use of Pe-Ce fibre and of nylon is described. Natural fibres, but not synthetic fibres, are resistant to mechanical stress; this is probably due to the fact that the natural products are protected partly by incrustations. C.

**Formaldehyde: Determination in Formalin-treated Fabrics.** G. zum Tobel and F. Vogel. *Zellwolle, Kunstseide, Seide*, 1941, 46, 59-61 (through *Chem. Zentr.*, 1941, ii, 3316 and *Chem. Abstr.*, 1944, 38, 2503<sup>1</sup>). Formaldehyde was determined by decomposing a sample with hydrochloric acid and precipitating it from the steam distillate with 5:5-dimethyldihydroresorcinol. Fabrics treated commercially with formalin contained 0.15-0.74 per cent. of formaldehyde. The reaction of these fabrics with various chemicals indicated that most of the formaldehyde was combined with the fibre chemically. In fabrics treated with

urea-formaldehyde resins there was no chemical union between the fabric and the formaldehyde. C.

**Nylon Fabric Weaving Defects: Causes and Correction.** R. E. Spear. *Textile World*, 1944, 94, No. 5, 101. Illustrations are given of weft defects due to (1) oil stains, (2) snarling, and (3) slack picks due to a rebounding shuttle, with hints on the correction of the trouble. C.

**Spun Rayon Fabrics: Quality.** H. Böhlinger and W. Graf. *Textilberichte*, 1943, 24, 347-357 (through *Chem. Abstr.*, 1944, 38, 2500<sup>2</sup>). A true comparison of the quality of fibres of different specific gravity is possible only for those textile structures containing the same weight of dry substance. Physical tests are described and discussed. C.

#### (D)—OTHER MATERIALS

**Paper Bursting Strength Tester.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1944, 118, *TAPPI*, 159-160. A revision of TAPPI standard T403m-41, giving specifications of a bursting strength test and instrument for papers up to 0.025 in. thick. C.

**Paper Stretch Testing Machines: Comparison.** Institute of Paper Chemistry. *Paper Trade J.*, 1944, 118, No. 26, 12-16; 119, No. 1, 24-30; No. 2, 24-30. A critical discussion is offered of the measurement of stretch in paper by means of (1) the Amthor universal tensile strength tester, (2) the Clark stretch tester, (3) the Schopper electrically-driven strength tester and (4) the Scott serigraph. The calibration of the machines is also considered. Defects of design are brought to light. The stretch of paper is found to decrease with increasing specimen length but to be virtually independent of width or of the rate of loading. C.

**Nitrocellulose Films: Plasticity.** Madeleine Raison and M. Marcal. *C. r. Acad. Sci.*, 1941, 212, 157-159 (through *Chem. Zentr.*, 1941, ii, 3226 and *Chem. Abstr.*, 1944, 38, 2199<sup>8</sup>). For experiments on the extension of nitrocellulose, small ribbons were used, 5 cm. long, 4 mm. wide and 0.04-0.07 mm. thick. They were kept in a tube which contained solvent. The extension curves always show the same form. There is a flat ascending portion (*H*) which corresponds to the elastic range, followed by a steeper portion which is ascribed to the plastic range (*P*). At higher concentrations of a softening agent in the solution, *H* is shortened, whereas the angle of inclination of *P* remains unchanged. With increasing amounts of the softening agent taken up, the curve increases in steepness, and coincides with the ordinate axis when the ratio of softening agent to  $C_6$  group reaches unity. The elasticity is then zero and the plasticity is complete. Whereas hexane and cyclohexane, used as solvents for the softening agent, do not change the mechanical properties of the films, films of nitrocellulose are plasticized by benzene. The portion *H* is almost non-existent, and portion *P* almost vertical, proving that benzene acts, in this system, as a plasticizer. C.

**Pulp: Viscosity Test in Cupriethylenediamine Solvent.** E. P. Wood. *Paper Trade J.*, 1944, 118, *TAPPI*, 169. The writer advocates a modification (not described) of Straus and Levy's viscosity test for pulps, using cupriethylenediamine solvent, on the score that it is quicker than the cuprammonium method, a single test requiring only 20 minutes. C.

**Sulphite Pulps: Viscosity; Comparison of Cuprammonium and Cupriethylenediamine Measurements.** A. J. Corey. *Paper Trade J.*, 1944, 118, *TAPPI*, 167-168. The author records the viscosities of 1 per cent. solutions of eleven samples of bleached sulphite pulp in cuprammonium and cupriethylenediamine as solvents. The respective values range from 10.5 to 85.5 cp. for the first solvent and 16.2 to 440 cp. for the second, and fall on a curve that is slightly concave towards the axis used for the cupriethylenediamine values. Four to eight measurements were made on each sample and a greater degree of uniformity was obtained when using the second solvent. C.

**Bacteria: Collection from Air and Textiles.** H. M. Lemon. *Proc. Soc. Exp. Biol. and Med.*, 1943, 54, 298-301 (through *Biol. Abs.*, 1944, F, 18, 6939). Air is dispersed at 30 l. per min. through a Folin aeration tube into 20 ml. broth and 2-3 drops olive oil contained in a 200 × 32 mm. test tube. Loss of fluid is prevented by exhausting the air through a Kjeldahl trap (square glass baffle) inserted into the same stopper that holds the Folin tube. Comparison with the

Moulton atomizer sampler in 26 tests with air of inhabited rooms and air infected with  $\beta$ -hemolytic streptococcus Group C, dispersed as fine droplets, showed this device to be 90 per cent. efficient. The number and type of bacteria on textiles can also be estimated by attaching a glass funnel to the intake of the sampler and drawing 30-60 l. of air through sheets or blankets. W.

#### PATENT

**Fabric Measuring Machine.** M. P. Oliver and W. T. Oliver. B.P.562,623 of 12/1/1943:10/7/1944. In a fabric measuring machine of the type in which the fabric is pulled between a measuring roller and a pressure roller, the pressure roller is mounted in a bracket secured to a rotatable shaft, the bracket being subjected to the action of a spring normally tending to press the roller towards the measuring roller, and the bracket being provided with a roller co-operating with a cam carried by a sliding frame normally urged in a direction to move the cam under the roller so as to hold the pressure roller in its inoperative position. C.

### 7—LAUNDERING AND DRY-CLEANING

#### (A)—CLEANING

**Alkylaminoethanol Invert Soaps: Preparation.** P. Rumpf and P. Kwass. *Bull. Soc. Chim.*, 1943, 10, 347-349 (through *Chem. Abstr.*, 1944, 38, 2317<sup>a</sup>). The preparation and properties of the following derivatives of aminoethanol are described: dibenzyl-, benzyl-, dihexyl-, hexyl-, didodecyl-, dodecyl-, and hexadecyl-. Their salts do not foam but are remarkable for emulsifying power. The hydrochlorides of the mono-derivatives are excellent sources of invert soaps. C.

**Double Invert Soaps: Preparation.** J. B. Niederl and E. J. Kenney. *J. Amer. Chem. Soc.*, 1944, 66, 840-841. Methylene- and benzal-di-morpholine have been condensed with a variety of alkyl bromides, such as *n*-butyl, *n*-heptyl, *n*-octyl, tetradecyl and hexadecyl bromides, to yield the corresponding symmetrical di-morpholinium di-bromides. C.

**Soap and Synthetic Detergent Mixtures: Analysis.** D. Berkowitz and R. Bernstein. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 239-241. A procedure for the analysis of mixtures of soap and synthetic detergents in bar form is described in which the sample is extracted with 95 per cent. ethyl alcohol to remove the major portion of the active ingredients and the residue is dissolved in the smallest possible quantity of water and reprecipitated by the addition of ethyl alcohol in order to free it from adsorbed detergent. Soap, fatty matter, and alcohol-soluble chlorides are determined directly and synthetic detergent is determined as the difference between total alcohol-soluble matter and the sum of soap, fatty matter, and alcohol soluble chlorides. Results obtained on known mixtures are of satisfactory accuracy and reproducibility. C.

**Textile Materials: Effect of Washing.** H. Opitz. *Mikrokosmos*, 1941, 34, 153-156 (through *Chem. Zentr.*, 1941, ii, 3014 and *Chem. Abstr.*, 1944, 38, 2502<sup>a</sup>). Microscopic observations have been made of the effects of washing on cotton, flax and viscose staple fibre. Commercial washing operations were carried out with completely softened water, a soda bath, washing for 10 min. in soap solution at 80°, after-treating in a Calgon bath, rinsing in warm, soft and in cold, hard water and centrifuging. The textiles were tested after 25, 50 and 100 such washings. The damage was greatest for the spun rayon, less for bast fibres and least for the cotton. Deposits, particularly of calcium soaps are harmful. These soaps are detected with alizarin solution. Photomicrographs are given in the original. C.

**Washing Compounds: Photometric Measurement of Detergent Power.** J. I. Wilson and E. E. Mendenhall. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 251-254. The calcium and magnesium salts present in hard water react with many detergents to form insoluble compounds. Some of the precipitate thus formed attaches itself to objects being washed and in some processes, such as commercial dish-washing, builds up an unsightly film. A simple photometer has been designed for measurements on such films. The transmission of light by test plates, comprising squares of plate glass is measured, before and after washing, by means of a photocell and a measuring circuit of relaxation oscillator type which causes a series of clicks to be heard in a high-impedance telephone. Results are expressed as visual thickness of film. The use of this instrument

for the determination of the rate of film formation in the washing of glass objects with different detergents is described. Curves are given showing visual thickness of films against number of wash cycles. Of the three alkaline materials, most commonly found in commercial dish-washing detergents, trisodium phosphate produced the least film during 10 repeated washing cycles. Sodium metasilicate produced a heavier film than trisodium phosphate under the test conditions, but less film than soda ash. A proprietary compound containing 25 per cent. tetrasodium pyrophosphate, 40 per cent. sodium metasilicate, and 35 per cent. soda ash produced after 10 cycles a film having a visual thickness of only 15 units as compared with 31 units for trisodium phosphate alone. A proprietary compound containing 32 per cent. of sodium tetraphosphate ( $\text{Na}_6\text{P}_4\text{O}_{13}$ ), 40 per cent. sodium metasilicate pentahydrate, and 28 per cent. of sodium carbonate gave a film of visual thickness less than 2 units. C.

#### PATENT

**Washing Machine Oscillating Mechanism.** British Thomson-Houston Co. Ltd. B.P. 563,020 of 28/12/1942:26/7/1944 (Conv. 31/12/1941). A variable-stroke oscillating mechanism for washing machines comprises a segment gear and a pinion, means for oscillating the segment gear about an axis, means for adjusting the axis of the segment gear toward and away from the pinion, and co-operating friction surfaces on the pinion and segment gear, the friction surface on the segment gear having a part on one side of an arc passing through its ends concentric with the axis of oscillation, whereby the length of friction contact between the segment and the pinion varies with the adjustment of the axis of the segment. C.

### 8—BUILDING AND ENGINEERING

#### (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**American Textile Machinery: Developments.** N. M. Mitchell. *Textile Manufacturer*, 1944, 70, 301-303. A useful list is given of new developments in spinning, winding, weaving, dyeing and finishing machinery, arranged in alphabetical order of the machinists' names. C.

**Cellulose Acetate Plastics: Moulding.** W. O. Bracken and F. E. Piech. *Ind. Eng. Chem.*, 1944, 36, 452-456. Strain patterns shown by translucent cellulose acetate injection-moulded plastics in polarized light have been studied and related to variations in temperature, pressure and other conditions of moulding. The results indicate that injection temperatures of cellulose acetate plastics should be sufficiently high to obtain homogeneity in mouldings. Lower temperatures result in poor fusion and a high degree of strain. High-acetyl (57 per cent. combined acetic acid) cellulose acetate injection plastics require high temperature, high pressure, and low rate of filling of the mould to produce heavy-sectioned pieces having minimum impressed strain. High temperature and pressure are necessary to obtain closest mould reproduction. Low rate of filling of the mould aids in forming bubble-free pieces. Cellulose acetate plastics of the P.M. type (53 per cent. combined acetic acid) generally require higher injection pressures than plastics of higher acetyl content to avoid bubble formation in thick pieces. Side gating is more effective than corner gating in producing pieces relatively free from strain. There are minimum pressures below which bubble formation consistently occurs in heavy mouldings. Increased mould temperatures and longer periods in warm moulds improve the strain structure of plastics. In the production of cellulose acetate sheet stock the following conditions give products with minimum strain: solvent content prior to baking about 17 per cent., baking temperature approximately 320° F., and cooling pressure 500-1,000 lb. per sq. in. C.

**Laminated Paper Plastics: Effects of Moisture Content on Physical Properties.** A. H. Croup. *Paper Trade J.*, 1944, 118, TAPPI, 175-178. Sheets of sulphite pulp paper were impregnated with an alcoholic solution of phenol-formaldehyde resin, conditioned at 9, 22, 32.5, 52.5, 64, 81 and 94.5 per cent. R.H., and made into laminated panels  $\frac{1}{8}$ -in. thick by compression for 12 minutes under 250 lb. per sq. in. at 160° C. About 60 sheets were required. The panels were then conditioned at 52 per cent. R.H. and 22° C. and submitted to various physical tests. The following data are tabulated and plotted against the per cent. R.H. at which the impregnated paper was conditioned: (1) total volatile matter (loss at 160° C.) and (2) moisture content, at the time of laminating;

and, for the laminate, (3) specific gravity, (4) moisture regain, (5) increase in thickness due to moisture absorption, (6) tensile strength, (7) modulus of elasticity, (8) modulus of rupture under flexing, (9) modulus of elasticity under flexing, (10) edge impact strength (Izod), and (11) resistance to abrasion. Test conditions are recorded. The results show that as the moisture content of the sheets increased the tensile and flexing strengths of the laminates decreased, the moisture absorption increased, dimensional stability became poorer, impact strength was slightly increased, and specific gravity and resistance to abrasion were not affected. It appears, therefore, that the moisture content of the impregnated paper should be controlled if strength and uniformity of the laminate are important consideration. In a second part of the investigation, panels made from three sorts of paper at the same regain were themselves conditioned at the above range of humidities, and also soaked in water, and tested for regain, tensile and impact strengths, and resistance to abrasion. The data are plotted against per cent. R.H. and the trends are discussed. It was subsequently realised, however, that laminated panels do not reach moisture equilibrium with the conditioning atmosphere in less than 3 months, whereas only 48 hours was allowed in these experiments. C.

**Phenol Paper Laminates: Development.** G. K. Dickerman. *Paper Trade J.*, 1944, 118, *TAPPI*, 239-242. The writer discusses the development of strong phenolic paper laminates for aircraft construction and gives data about the engineering properties of recent products. The need for specifications of the paper is pointed out. C.

**Air Compressors.** D. Braid. *Mech. World*, 1944, 115, 285-9, 371-8. In the erection of a compressor and its prime mover the important points to watch are the foundations, the setting of the bedplate, and the aligning of bearings and shafts. The procedure and points to watch in starting up a new installation or after an overhaul are considered in some detail. La.

**Pipe Joints.** G. W. McArd. *Mech. World*, 1944, 115, 382-3, 391-3. Joints and jointing materials are discussed under the headings joint tightness, design and machining, jointing material, jointing pressure, and fluids. A table shows recommendations of three manufacturers for materials for use with different fluids. La.

**Electric Welding Plant.** G. W. Stubbings. *Mech. World*, 1944, 116, 123-4. A brief consideration of load factor with particular reference to supplies for electric welding plant and the principle of static equipment for balancing a single phase load on a 3-phase system. La.

**Wood in Modern Construction.** G. W. McArd. *Mech. World*, 1944, 116, 227-32. The supply and properties of various woods are first considered and the latest developments in bonded plywood, moulded plywood and combinations of asbestos board and plywood are illustrated and described. La.

**Lubricating Appliances.** E. V. Paterson. *Mech. World*, 1944, 116, 255-60. Present day lubricating equipment is illustrated and described. Included are simple oilers, wick feeds, drop oilers and mechanical lubricators. La.

**Heat Exchange.** C. H. Fielding. *Power & Works Engineer*, 1944, 39, 80-2, 108-11. Among the many factors encountered in heat transfer problems is the way in which the physical proportions affect the heat exchange. These articles are particularly concerned with surface and volume and the relation between heat transfer and surface/volume is examined for pipes, condenser tubes, heat exchangers, fine wires. La.

**Reducing Factory Noise.** *Mech. World*, 1943, 114, 763. Notes on the use of sound absorbing materials based on a recent American paper. La.

**Industrial Chromium Plating.** *Power & Works Engineer*, 1944, 39, 187. A discussion of why and how chromium plating is employed in numerous cases in machine tool and other engineering fields. La.

**Safety in Process Equipment.** *Power & Works Engineer*, 1944, 39, 10-11. Notes on Hazards associated with process apparatus, with special reference to explosion in direct fired furnaces. La.

**An Aquatherm Installation.** *Power & Works Engineer*, 1944, 39, 29-31. A description of some of the engineering services at the factory of the Empire

Rubber Co., including a very satisfactory high-pressure water circulating system for process purposes. La.

**Compressor Economies.** "Pneumatic." *Power & Works Engineer*, 1944, 39, 36, 38. Notes on simple and practical methods of improving the production of compressed air. La.

**Engineering Fundamentals 22.** *Power & Works Engineer*, 1944, 39, 112-3. Some alternating current appliances are considered. La.

**Models.** *Power & Works Engineer*, 1944, 39, 164. Models are extremely useful in engineering and chemical engineering and they are here discussed under the headings: materials, model makers, plastics, the cost aspect. La.

**Practical Pointers.** J. G. Berger. *Starchroom Ldy. J.*, 1944, May, 88. Twelve suggestions to help to keep plant running under difficult maintenance conditions. They include a soot remover, locating cracks in metal plant, making a tight joint and so on. La.

**Power Plant Notes.** W. F. Schaphorst. *Starchroom Ldy. J.*, 1944, May, 96-9. Notes on starting a new boiler, in lieu of rubber, test lubricants and bearings, burning air, belts on flanged pulleys, steam leaks, safety valves. La.

**Earthing Electrical Plant.** G. W. Stubbings. *Power & Works Engineer*, 1944, 39, 175-6. The reasons for earthing the frames of motors and other equipment are explained and the necessity for regular inspection and testing of earth continuity connections is stressed, with particular reference to factory conditions. La.

#### (C)—STEAM RAISING AND POWER SUPPLY

**Chatter in Safety Valves.** G. H. Pearson. *Mech. World*, 1944, 115, 575-6. There is less proneness to chatter in the case of safety and other controlled lift valves if the point of thrust of the valve spindle is situated at some distance below the contacting faces of the valve members. La.

**The Mol in Combustion Calculations.** J. Jennings. *Mech. World*, 1944, 115, 627-8. The "mol" is the quantity of matter whose weight is equal to its molecular weight in pounds and it is an exceedingly useful unit in combustion calculations. Examples are given for the combustion of acetylene and a flue gas analysis. La.

**Boiler Feed Systems.** H. Hillier. *Mech. World*, 1944, 116, 125, 132-7, 163-5, 188-92, 208-9. In an abstract of a paper on "Boiler Feed Water Regulation" (presented to Institute of Marine Engineers) feed system characteristics are first analysed. A number of feed installations and control devices are illustrated and described. La.

**Overload Trips for Electric Motors.** G. W. Stubbings. *Mech. World*, 1944, 116, 206-7. The basic characteristics of thermal overload trips for electric motors are considered and from these are developed two practical rules for operation. La.

**Steam Pipe Insulation.** H. Buckley. *Mech. World*, 1943, 114, 753-6, 778-9. After considering the heat loss theoretically, including the values of constants for various materials, the economic aspect is discussed, and a method is evolved for finding the economic thickness. General characteristics of insulating materials, their choice, fixing and finishing are also briefly considered. La.

**Installation and Care of Electric Motors.** Engineer-in-Charge. *Mech. World*, 1944, 115, 171-5. The type of motor must be suited to the working conditions and the maintenance must be suited to the requirements for efficient performance of the type chosen. The subject is considered under the headings: conditions and type, starting and cables, drive, maintenance of bearings, loading and connections, collecting gear and insulation tests. La.

**Boiler Fittings.** G. H. Pearson. *Mech. World*, 1944, 115, 199-202, 249-51, 274-7, 303-7, 331-5. An interpretation of B.S. 759-1937 dealing with valves, gauges and similar fittings for land boiler installations. The specification is considered in detail and many diagrams are included to illustrate various points. La.

**Process Steam and Power.** H. M. Peacock. *Power & Works Engineer*, 1944, 39, 5-8, 32-4, 57-8, 89-92, 104-6. A comprehensive treatment of the whole subject of generating power in establishments using steam for press or heating. In



general the exhaust steam is used for process at pressures ranging from 10-100 p.s.i. and for normal factories the boiler pressure should be at least 150 p.s.i. to make "back-pressure" power generation worthwhile. "Pass out" sets are used when the power required would yield more exhaust steam than could be absorbed by process. Comparison between power station and local generation is made by means of Sankey diagrams and illustrative cost figures, and the advantages of back-pressure generating plant are clearly shown. A table shows the horsepower to be expected from a variety of reciprocating engines and turbines and consideration is then given to the theoretical aspect starting with the Rankine diagram and Willans line. The working pressures are considered in some detail and the desirability of avoiding reducing valves is stressed. Whenever the exhaust steam is insufficient for or balances the process requirements care should be taken to introduce the maximum heat economy or to ensure an hour to hour balance as well as a weekly or daily balance. A number of ways of using excess exhaust steam are considered including the purchase of electric power, the installation of a heat accumulator or exhaust turbine. A final section describes the use of the Mollier diagram in power plant problems.

La.

**Engineering Fundamentals 18.** *Power & Works Engineer*, 1944, 39, 18-19. Notes on the direct current dynamo.

La.

**Engineering Fundamentals 19.** *Power & Works Engineer*, 1944, 39, 39-40. The direct-current motor.

La.

**Steam and Power Balancing.** H. M. Peacock. *Power & Works Engineer*, 1944, 39, 125-7. Methods of improving the balance between steam loads and power demand in factories employing combined power-process steam systems are briefly discussed.

La.

**Economiser Performance.** R. H. Parsons. *Power & Works Engineer*, 1944, 39, 129. An alignment chart is given and described enabling economiser heat transmission to be estimated from the two temperature differences (i.e. gas inlet, water inlet) and the water-flow per sq. ft. of heating surface. Any deterioration in efficiency is readily found.

La.

**Outcrop and Opencast Coal.** J. N. Williams. *Power & Works Engineer*, 1944, 39, 135-6. The general characteristics of these coals are first discussed briefly and then the firing technique is considered. In general side firing is to be preferred, but proper fire cleaning is essential.

La.

**Energy Cost for A.C. Motors.** G. W. Stubbings. *Mech. World*, 1944, 115, 718-9. A note on balancing the cost of complication against the effect of a gain in power factor.

La.

**Power Rectifier.** J. Tyler. *Power & Works Engineer*, 1944, 39, 153-4. A survey of the types of power rectifier available commercially for heavy work, including a review of progress and an estimation of the probable trend.

La.

**Surface Condensers.** W. Miles. *Power & Works Engineer*, 1944, 39, 158-9. A brief consideration of surface condensers, including a condenser performance chart.

La.

**Calorific Value.** R. H. Parsons. *Power & Works Engineer*, 1944, 39, 163. A diagram which enables an estimate of the calorific value to be made from the proximate analysis is illustrated and described.

La.

**Power from Process Steam.** R. Hammond. *Steam Engineer*, 1944, 13, 326-331. The first of a series of articles describing different types of plant designed to make the maximum use of the heat in steam for power and process purposes. This article describes a Sulzer compound (tandem) engine and plant working with steam extraction.

La.

**Coke Breeze and Pitch.** *Steam Engineer*, 1944, 13, 347-8. A brief account of experiments carried out by the Chemical Engineering and Wilton's Patent Furnace Co. Ltd. to examine the conditions under which coke breeze and pitch can be burnt on boiler furnaces. A special trough for mixing the pitch and coke breeze is illustrated diagrammatically the mixture consisting of about 15 per cent. of pitch by weight. An increase in efficiency over coke breeze used alone was obtained, the evaporation from and at 212° F. rising from 5.52 to 6.07 lb. of water per lb. of fuel.

La.



**Changing from D.C. to A.C.** *Power & Works Engineer*, 1944, 39, 178-9, 182. A factory engineer records his experience while changing a factory from D.C. to A.C. La.

**New Economisers.** W. Goldstern. *Steam Engineer*, 1944, 13, 134-8. Some notes on the selection of a new economiser for an industrial installation. La.

**Dust, Soot and Efficiency.** W. Goldstern. *Steam Engineer*, 1944, 13, 167-70. The effect of flue dust and soot deposit on the efficiency of Lancashire boilers is examined by considering actual figures for boiler house data from textile mills. La.

**Boiler Efficiency.** H. L. Pirie. *Steam Engineer*, 1944, 13, 199-203. Practical notes on boiler efficiency include illustrations and descriptions of an air excluder for a side flue damper of a Lancashire boiler, critical positions of dampers, path of gases with and without baffles, a flue striking pillar and Bower baffles. Several general points are also briefly considered. La.

**Safety Valves.** E. Ingham. *Steam Engineer*, 1944, 13, 249-51. A common type of high steam and low-water safety valve is illustrated and the correct procedure for ensuring its efficient operation is described. La.

**Extraction Steam from a Corliss Engine.** S. Bentley. *Steam Engineer*, 1944, 13, 264-8, 263. Some notes on an interesting extraction system applied to an existing Corliss engine at a Yorkshire woollen mill. La.

**Uniflow Engine.** *Steam Engineer*, 1944, 13, 365-8. Some notes on an installation in a hosiery plant, including a small water tube boiler and a uniflow engine providing exhaust process steam. La.

**Combustion in Shell-type Boilers.** E. E. Burrage. *Steam Engineer*, 1944, 13, Supplement (Sept.). Coloured diagrams illustrate furnace and chimney top conditions for a shell-type boiler fitted with a sprinkler stoker. Five states of the fire are shown with relevant descriptive information, including per cent. CO<sub>2</sub>, excess air and heat loss. La.

**Industrial Heat Insulation.** W. Francis. *Power & Works Engineer*, 1944, 39, 149-52, 183-6, 204-7. A straightforward explanation of the economics of thermal insulation with particular reference to factory steam and hot-water services. The first section considers heat loss theoretically and tables of constants for various insulating media are given. The economics of the system are next considered by plotting first the heat savings and the annual cost of the lagging and combining these to give a total cost curve. This curve has a minimum at the most economical thickness. Certain practical aspects, e.g. resistance to moisture, cost of application, are then discussed. Finally the properties of commercial types of lagging and some miscellaneous applications are described. La.

**"Reflex-Ordinate" Boiler Efficiency Diagram.** H. C. Golder and R. B. Page. *Power & Works Engineer*, 1944, 39, 40, 56. This diagram allows the efficiency of a boiler to be estimated by means of a series of points and lines. The order in which the components are used is steam temperature, gauge pressure, feed temperature, calorific value of fuel, actual evaporation and efficiency. The low range chart covers steam temperatures from 290°-600° F. and pressures from 50-250 p.s.i.g., while the higher range chart covers temperatures from 500°-800° F. and pressures from 100-500 p.s.i.g. Larger scale charts can be obtained. La.

**Cast-iron Heating Boilers.** J. Evens. *Power & Works Engineer*, 1944, 39, 41-2. A brief discussion of some of the causes that lead to cracking and breakdown of cast-iron sectional and other heating boilers, together with suggestions for their avoidance. La.

**Economisers and Air Preheaters.** W. Wadkin. *Power & Works Engineer*, 1944, 39, 44-6. Factors controlling the relative sizes of economisers and air preheaters in modern boiler plant are considered. La.

**Fuel Characteristics and Boiler Efficiency.** R. Rowatt. *Power & Works Engineer*, 1944, 39, 60-2. A general discussion on the effect of coal characteristics on combustion efficiency, with suggestions for improving existing and maintaining better boiler house operation. La.

**High-speed Electric Drives.** G. W. Stubbings. *Power & Works Engineer*, 1944, 39, 63-4. The method of operation of the induction frequency-changer is explained as it is the normal modern equipment used to secure higher frequency supplies for high-speed electric drives of hand tools, wood-working machines, etc. La.

**Elementary Lagging.** *Power & Works Engineer*, 1944, 39, 64-5.

**Engineering Fundamentals 20.** *Power & Works Engineer*, 1944, 39, 66-7. A brief account of alternating currents and their behaviour in circuits having inductance and capacitance. La.

**Engineering Fundamentals 21.** *Power & Works Engineer*, 1944, 39, 83-4. Further considerations relating to alternating currents and their practical implications. La.

**Boiler Operation.** C. H. Fielding. *Power & Works Engineer*, 1944, 39, 197-8, 208. Diagrams giving a useful picture of the variable factors involved in practical boiler operation can be prepared from easily available data. Examples are illustrated and described with special reference to chain-grate fired water tube units. La.

**Lubrication of Gears and Gearboxes.** E. V. Paterson. *Mech. World*, 1944, 115, 505-6, 532-5, 561-2. Dissipation of heat is the most important function of oil in gear boxes and in order to obtain the most satisfactory results certain points must be watched. The sources of friction are between the meshed teeth, the oil itself and the churning of the oil. The first demands a high viscosity oil and the last two a low one so that a compromise has to be made. The required viscosity and other properties of suitable lubricants are briefly considered. Typical gearboxes and methods of applying the oil, e.g. pressure feed, spray lubrication are illustrated and described. La.

**Lubrication of Plain Bearings.** E. V. Paterson. *Mech. World*, 1944, 116, 199-203. The basic principles are discussed and applied to the grooving of bearings. The distribution of pressure in an oil film, clearances, effect of surface finish, effect of shaft distortion, correct point of introducing oil, dangers of oil grooves, force feed systems and similar points are briefly considered. La.

**Ball and Roller Bearings.** R. K. Allan. *Mech. World*, 1944, 115, 149-52. Ball and roller bearings give long and efficient service if they are of the correct size and type and due care is exercised in their handling, fitting and maintenance. Drawings and instructions should be studied before fitting or dismantling to find what tools are required. Handling, fitting, lubrication, sealing, maintenance, unsatisfactory running, dismantling, repairing and cleaning are also considered. La.

**Metallic Packing.** R. W. McArd. *Power & Works Engineer*, 1944, 39, 155-8. The value of metallic packing for sealing reciprocating rods and revolving shafts is discussed and several examples are illustrated and described. La.

**Centrifugal Compressors.** W. J. Roberts. *Power & Works Engineer*, 1944, 39, 77-9. An outline of the principles and plant employed for the control and regulation of air compressors. La.

**Power Transmission.** E. L. Cady. *Ldy Age*, 1944, June, 57-8, 60, 62, 64. One of the most important factors in power transmission maintenance is alignment. Causes of wear and types of misalignment are illustrated and discussed and methods of ensuring correct alignment of shafts, pulleys and motors are described. La.

**Lubrication of Plain Bearings.** E. V. Paterson. *Mech. World*, 1944, 116, 314-6. Methods of applying grease for the lubrication of plain bearings are illustrated and described. La.

#### (D)—POWER TRANSMISSION

**Lubricating Oils: Oxidation.** G. H. Denison, Jr. *Ind. Eng. Chem.*, 1944, 36, 477-482. Refined lubricating oils consist of hydrocarbons, together with 2-20 per cent. sulphur compounds, 0.08-0.3 per cent. nitrogen compounds and some oxygen compounds. The hydrocarbon fraction is a mixture of naphthenes with homologues of benzene and naphthalene. When the natural sulphur compounds are removed without appreciably affecting other constituents, the hydrocarbon fraction shows negligible resistance to oxidation. The stability of

lubricating oils thus appears to depend on the presence of the natural sulphur compounds. Studies of the mechanism of oxidation of a sulphur-free oil and observations of the rate of peroxide decay when blends of a finished lubricating oil with a sulphur content of 0.53 per cent. and a peroxide-rich pre-oxidised white oil are heated in the absence of air show that the hydrocarbon fraction oxidises at a rate controlled by the concentration of organic peroxides, and that the latter are reduced by reaction with inhibitors that contain sulphur. Further experiments show that, in addition to controlling the rate of oxidation of an oil, the organic peroxides determine the rate of corrosion of bearing metals. The corrosion results from the ability of peroxides to convert metal into metal oxide, the latter subsequently dissolving by reaction with acidic constituents developed during oxidation. C.

**Motor Starters: Maintenance.** J. Z. Linsenmeyer and L. E. Markle. *Textile World*, 1944, 94, No. 4, 98-101, 180. Practical advice is given on the care, testing and maintenance of motor starters. The hints are summarised in a table in which the headings are (1) nature of the trouble, (2) cause and (3) what to do. C.

**Chain Drives: Maintenance.** Chain Belt Co. *Textile World*, 1944, 94, No. 5, 134. A table is given of symptoms of bad running of driving chains, with possible causes and remedies. C.

#### (F)—LIGHTING

**Textile Mills: Lighting.** *Textile World*, 1944, 94, No. 4, 104-105. Many textile processes require good general illumination supplemented by effective local lighting. The following intensities (foot-candles) are recommended:

	General	Local		General	Local
Storage ... ..	5-10	—	Drawing-in ... ..	25-30	100-200
Opening and scutching ...	10-20	—	Full-fashioned knitting ..	35-40	—
Carding ... ..	10-20	—	Circular knitting ... ..	35-40	—
Roving ... ..	35-40	—	Looping ... ..	35-40	100-200
Spinning (ring) ... ..	35-40	—	Seaming ... ..	35-40	100-200
Twisting ... ..	35-40	—	Cloth inspection ... ..	30-35	100-200
Mule spinning ... ..	50-55	—	Knit goods inspection ...	30-35	100-200
Throwing ... ..	30-35	—	Narrow fabrics inspection	30-35	150-250
Winding ... ..	30-35	—	Printing ... ..	30-35	75-150
Sizing ... ..	25-30	100	Perching ... ..	30-35	100-250
Warping ... ..	30-35	100-150	Shading ... ..	30-35	100-150
Weaving ... ..	25-50	100	Machine shop ... ..	25-30	100-300

C.

**Workshop Lighting.** *Mech. World*, 1944, 115, 419-21. Notes on a memorandum on "Workshop Lighting and Production Efficiency," issued by the E.L.M.A. Lighting Service Bureau. La.

#### (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Electronic Control Equipment: Maintenance.** W. D. Cockrell. *Textile World*, 1944, 94, No. 5, 82-83. Practical hints are given on the supervision of electronic control equipment, including the location of defects. C.

**Temperature Drop in Ducts.** A. B. Kratz, S. Konzo and R. B. Engdahl. *Mech. World*, 1944, 116, 264-5. An abstract of Bulletin No. 351 (University of Illinois) giving data for the calculation of the drop in temperature of heated air conveyed in galvanised-iron ducts of round, square and rectangular section, uninsulated and in a horizontal position. La.

#### (H)—WATER PURIFICATION

**Mechanical Filtration of Water.** J. J. Dillwyn. *Mech. World*, 1944, 115, 433-7. An abstract of a paper read before the Manchester Association of Engineers. Equipment is illustrated and described for filtration by the slow sand, rapid gravity and pressure processes. La.

**Water for Industrial Use.** J. Brittain. *Mech. World*, 1944, 115, 1-3. The preliminary treatment of water for industrial purposes includes the removal of debris. Suitable screens, strainers, and so on, are briefly described. La.

**Water Supply.** J. G. Berger. *Starchroom Ldy J.*, 1944, June 15, 94, 96, 105, 106. The economics of using town or well water are discussed and the advantages

of softening to zero hardness are emphasised by examples of savings so produced in ten different localities. La.

**Submersible Pump.** *Power & Works Engineer*, 1944, 39, 211-3. An illustrated description of a big wet-motor submersible pump recently supplied by Hayward-Tyler & Co. Ltd. for dewatering a colliery shaft. The motor is rated at 350 b.h.p. and will absorb 290 b.h.p. while raising 700 g.p.m. against a total head of 1,030 ft. La.

## 9—PURE SCIENCE

**Electron Tubes: Principles and Characteristics.** A. W. Kramer. *Instruments*, 1944, 17, 206-209, 224-228. The principles and characteristics of the tetrode and pentode are described, and modern X-ray and cathode-ray tubes are briefly discussed. C.

**Lanosterol.** C. Dorée and J. F. McGhie. *Nature*, 1944, 154, 147-148. Recent evidence indicates that lanosterol is probably connected with the tri-cyclic terpenes, e.g.  $\alpha$ -elemolic acid and with cryptosterol. A series of yellow ketonic products has been isolated by oxidising lanosterol and its esters with ozone and with chromic acid. These derivatives include a diketo-alcohol,  $C_{30}H_{46}O_3$  (m.p. 145°), the corresponding triketone,  $C_{30}H_{44}O_3$  (m.p. 110°), and a compound  $C_{27}H_{40}O_4$  (m.p. 203°), of which an account will shortly be published. W.

**Analysis of Hair Keratin. (2) Dicarboxylic and Basic Amino-acids of Human Hair.** J. M. R. Beveridge and C. C. Lucas. *Biochem. J.*, 1944, 38, 88-95. The influence of the order of separation of the amino-acids from a human hair hydrolysate upon their quantitative isolation has been investigated. A suitable order of separation of the dicarboxylic and dibasic amino-acids is reported. Aspartic acid (3.5 per cent.) has been isolated for the first time from human hair. Glutamic acid has been isolated in higher yields than previously reported. The quantities of basic amino-acids isolated agree essentially with those reported in the literature. The unexpected finding of methionine in a fraction derived from a washed and reprecipitated cuprous mercaptide precipitate casts some doubt upon the universal applicability of the method of estimating cystine by the organic sulphur content of this precipitate. W.

**Analysis of Hair Keratin. (3) Isolation of Proline from Human Hair.** J. M. R. Beveridge and C. C. Lucas. *Biochem. J.*, 1944, 38, 95-97. Conditions for the quantitative isolation of proline, suitable for use in a systematic scheme of separation of amino-acids from hydrolyzed hair keratin, have been studied. Maximum yield of proline (4.3 per cent.) was obtained by application of Town's copper salt method, after preliminary removal of cystine, arginine, most of the tyrosine, the dicarboxylic acids, histidine, lysine and some leucine. No hydroxyproline could be found in human hair hydrolysates. W.

**Action of Sulphites on the Cystine Disulphite Linkages of Wool. (4) Methylation of the Thiol Groups of Bisulphited Wools.** S. Blackburn, R. Consden and H. Phillips. *Biochem. J.*, 1944, 38, 25-29. The thiol groups produced when wool is treated with sodium bisulphite can be methylated by methyl iodide or methyl bromide; the S-cysteinesulphonate groups are unaffected. A similar reaction occurs when wool is treated simultaneously with sodium bisulphite and dimethyl sulphate. A technique for the isolation of S-methylcysteine from hydrolysates of S-methylated wools by partition chromatography of the N-acetylated amino-acids is described. W.

**The Chemistry of Protein Denaturation.** H. Neurath, J. P. Greenstein, F. W. Putnam and J. O. Erickson. *Chem. Reviews*, 1944, 34, 157-265. An extremely comprehensive review covering all aspects of the subject. 418 references are included. W.

**Insect Cage Olfactometer.** G. A. Hepburn. *Onderstepoort J.*, 1943, 18, 7-12. A simple type of cage olfactometer is described. This has been evolved for studies of sheep blowflies, particularly *Lucilia cuprina* Wied., but with modifications may be used for studying the olfactory responses of various species of insects. W.

**Prevention and Treatment of Blowfly Strike in Sheep: Recent Advances.** *Australia: Council Sci. Ind. Res., Bull.* 174, 1943. Supplement to Report No. 2 of Joint Blowfly Committee (these *Abs.*, 1940, A593). Attention is drawn to

improved methods for preventing and treating blowfly strike evolved since the publication of Report No. 2. Work on selection and breeding indicates that the use of plain parents is not sufficient to obtain a high percentage of A class (plain-breeched) sheep, and that the use of progeny-tested rams is necessary. In breeding towards plainness of the breech, there has been no loss in the quality and weight of wool produced. Short docking of the tail should be avoided; the tip of the healed stump should reach just below the tip of the vulva. A modified form of the Mules operation is described; this aims not only at removing the folds of skin from the centre of the breech, but also at producing the maximum expansion, by stretching, of the "bare area." Details are given of two improved boric acid dressings, B.T.B. and B.K.B. W.

**Upland Cotton: Inheritance of Green and Brown Lint.** T. R. Richmond. *J. Amer. Soc. Agron.*, 1943, 35, 967-975 (through *Plant Breed. Abstr.*, 1944, 14, 142). The genetical behaviour of lint pigmentation in cotton has been studied on Texas Green Lint, Nankeen (dark brown lint), Texas Rust (light brown lint), Higginbotham (light brown lint) and normal white-linted varieties. Pigmentation of the first three varieties is conditioned by a single gene which is incompletely dominant to white. The genes for Texas Rust and Nankeen are allelic and appear to be independent of Texas Green Lint and Higginbotham which are also independent of each other. An association was observed between the green and brown lint genes and a reduction in the weight of fibre per unit length. C.

**Aspergillus Glaucus: Effect of Atmospheric Humidity.** B. Stille. *Vorr. Pfl. Lebensm.-Forsch.*, 1942, 5, 403-408 (through *Chem. Zentr.*, 1943, ii, 967 and *Rev. Appl. Mycol.*, 1944, 23, 161). *Aspergillus glaucus* is extremely xerophile, being the last of the organisms tested to cease growth with declining atmospheric humidity; the germination and spore formation limits were 70 and 74 per cent. R.H., respectively, at the optimum temperature of 31° C. In practical storage trials with unpacked dried vegetables at 31°, 77 per cent. R.H. was the lower limit for risk of spoilage by *A. glaucus*. No other dried products are as sensitive to fungal damage as vegetables. C.

**Coloured Solutions: Acidity Determination.** V. B. Evstigneev. *Zavod. Lab.*, 1940, 9, 1032-1034 (through *Brit. Chem. Physiol. Abstr.*, 1944, C, 1). The acid solution in the cell quinhydrone electrode, acid solution|saturated potassium chloride|mercurous chloride, mercury is titrated until the e.m.f. of the cell vanishes. C.

**Potato Starch Moisture: Determination.** W. L. Porter and C. O. Willits. *J. Assoc. Offic. Agric. Chemists*, 1944, 27, 179-194. Methods for the determination of moisture in cereals and similar products are reviewed, and an account is given of investigations of determinations of the moisture content of starch by distillation procedures, the Karl Fischer chemical method, and gravity convection, mechanical convection, and vacuum oven methods. The effects of time and temperature on the loss in weight of potato starch on oven drying were determined. It was found possible to obtain reproducible results by heating to constant weight at temperatures in the range of 135-145° C. in the Brabender moisture tester and the adoption of this procedure as a basic method is proposed. Modifications of some of the other methods are described that lead to results in agreement with those of the basic method. C.

**2:4-Dinitroaniline: Determination in Food and Drug Dyes.** O. L. Evenson. *J. Assoc. Offic. Agric. Chemists*, 1944, 27, 131-134. Details are given of a colorimetric method for the determination of 2:4-dinitroaniline in D & C Orange No. 17, in which the intermediate is extracted with ether and determined by the intensity of its red colour with aqueous-alcoholic sodium hydroxide. The spectral characteristics of this colour are shown by extinction curves. C.

**Food Dye D & C Red No. 18: Analysis, Purification and Spectrum.** S. H. Newburger. *J. Assoc. Offic. Agric. Chemists*, 1944, 27, 134-139. A method for the determination of D & C Red No. 18 involves conversion of the dye to a water-soluble product by sulphonation, and titration with a standard solution of titanium trichloride. A procedure for the purification of the commercial dye is described. Extinction curves of the dye at various stages of purification and in chloroform solution at various concentrations, in the spectral region 400-750

$m\mu$ , are presented together with the extinction curve of the sulphonated dye. Spectrometric determinations are possible. C.

**Glucose: Photometric Determination.** N. Nelson. *J. Biol. Chem.*, 1944, **153**, 375-380. A photometric method is described for the determination of glucose (or reduction equivalent) with copper reagents and an arsenomolybdate reagent, details of the preparation of which are given. Representative data show that the optical density of the colour developed is proportional to the glucose taken and is stable over long periods of time. Applications of the method to the determination of glucose in blood filtrates are discussed. C.

**Wax: Determination in Paper Sizing Products.** W. E. Shaefer and A. C. Dreshfield. *Paper Trade J.*, 1944, **118**, *TAPPI*, 210. The authors' method depending on the solubility of wax in hot acetic anhydride and relatively low solubility in the cold has been modified to make it more suitable for pastes and certain dry sizes. One litre of a mixture of acetic anhydride (95) and acetic acid (5) is heated with 10 grams of wax of the type under test, cooled to about 25° C. and decanted through a fine copper screen. One portion is then cooled to 0-2° C. and another to 20° C., and filtered rapidly, to give the extracting solvent and the washing liquid, respectively. C.

**Cellulose: Nitration in Nitric Acid Vapour.** G. I. Wilson and F. D. Miles. *Trans. Faraday Soc.*, 1944, **40**, 150-163. A weighed bundle of ramie was suspended on a quartz-spring balance and a stream of nitric acid vapour was passed through it at the desired pressure. Experiments were carried out at pressures of 4-16 mm., temperatures of 20° and 40° C., and various times up to 40 hours, and at the end of each run the product was analysed and the degree of nitration found. From this and the final weight indicated by the quartz spring, the nitric acid absorbed and that which had reacted were calculated. The water present as a result of nitration was estimated. Measurements were also made at several temperatures and pressures of the absorption of nitric acid molecules on fully nitrated cellulose. The results show that absorption of nitric acid on the cellulose fibres takes place and reaches a maximum in about three hours. The nitration reaction is a consequence of this absorption and attains its greatest rate about the same time that the absorption reaches its maximum. This rate of nitration is independent of the pressure of nitric acid vapour in the gas-phase, but is related to the amount of acid which is absorbed without chemical reaction. The rate of nitration is roughly proportional to the square of this absorbed amount. From this it is inferred that two molecules of nitric acid are concerned in the conversion of a hydroxyl group—one to nitrate it, the other to accept the water of reaction. The chemical equation is therefore  $-\text{OH} + 2\text{HNO}_3 = -\text{O}\cdot\text{NO}_2 + \text{HNO}_3\cdot\text{H}_2\text{O}$ . This view of the reaction is supported by the fact that for denitration both water and nitric acid must be present, water alone being ineffective. Certain necessary modifications of the simple equation, rate of nitration =  $K$  (absorbed nitric acid)<sup>2</sup>, are discussed. The presence of water of reaction undoubtedly reduces the number of active  $\text{HNO}_3$  molecules. Absorption on nitrate groups must take place, but the influence of this is uncertain. An equation which is preferred and fits the experimental data contains two correction terms for these effects. The evaluation of these terms is described and the calculated and experimental values of the reaction rate are compared. Cellulose nitrate prepared in this way contained up to 13.4 per cent. N. Fractionation showed the products to be of abnormal solubility in acetone. C.

**Nitrocellulose: Denitration.** K. Fabel. *Nitrocellulose*, 1941, **12**, 143-146 (through *Chem. Zentr.*, 1941, **ii**, 3127 and *Chem. Abstr.*, 1944, **38**, 2199<sup>b</sup>). On centrifuging nitrocellulose wet with acid, partial denitration occurs, resulting not only in lowered yields of nitrocellulose, but also in reduced clarity of solutions and films prepared from the nitrocellulose. This denitration is avoided by preventing access of air during centrifuging. X-Ray investigation of the denitration process is discussed. C.

**Nitrocellulose: Solubility in Mixtures of Ether and Alcohol.** A. Kraus. *Nitrocellulose*, 1941, **12**, 123-124 (through *Chem. Zentr.*, 1941, **ii**, 3127 and *Chem. Abstr.*, 1944, **38**, 2199<sup>g</sup>). The solubility of nitrocellulose in mixtures of ether and alcohol is explicable on the basis of the similarity of the polar char-

acter of the latter to that of the nitrocellulose molecule. With increasing nitrogen content of the nitrocellulose, increase in the proportion of ether in the mixture is more favourable. C.

**Polysaccharides: Oxidative Degradation.** G. Jayme, M. Sätre and S. Maris. *Naturwissenschaften*, 1941, 29, 768-769 (through *Chem. Abstr.*, 1944, 38, 2197<sup>b</sup>). Low yields of glyoxal and erythronic acid were obtained when cellulose or starch was oxidised with 10 per cent. periodic acid at pH 1. Oxidation of cellulose with buffered 10 per cent. periodic acid at pH 3.5-4.0 transformed C<sub>2</sub> and C<sub>3</sub> into aldehyde groups in 97.5-99 per cent. yield, the polymeric otherwise remaining unchanged. The new compound was insoluble in the oxidising solution, but 95 per cent. was soluble in boiling water. After hydrolysis with 0.1N. sulphuric acid, glyoxal in 39.3 per cent. yield could be isolated as the phenylosazone. Xylan, oxidised and treated in like manner, yielded 62.4 per cent. of glyoxal. Glyceraldehyde, formed during the oxidation from C<sub>3</sub>, C<sub>4</sub> and C<sub>5</sub> of the carbohydrate, was isolated in 44.9 per cent. yield as the methylglyoxalosazone by distillation from 20 per cent. sulphuric acid. Further oxidation of the original periodic acid oxidation product gave rise to glyceric acid which was isolated after sulphuric acid hydrolysis in 65.2 per cent. yield as the brucine salt. When the original periodic acid oxidation product was reduced with hydrogen and a Raney-nickel catalyst, glycerol and glycolaldehyde were isolated after hydrolysis. Better yields of the latter two compounds were obtained by frequently alternating reduction and hydrolysis. In this manner a mixture of glycerol and glycol was obtained in 51.6 per cent. yield, 76.5 per cent. of which was glycerol. Oxidation of powdered straw with buffered periodic acid yielded 20 per cent. of a soluble oxidation product. The insoluble material upon further bromine oxidation gave rise to a mixture of organic acids. C.

**Starch: Acetylation.** L. T. Smith and R. H. Treadway. *Chem. Eng. News*, 1944, 22, 813-817. A report is given of investigations into the best conditions for acetylating starch by (1) mixtures of acetic acid, acetic anhydride and a catalyst, and (2) acetic anhydride alone after a swelling treatment. The second method, under the best conditions, led to complete acetylation, with but slight degradation, in 1 hour as against 9 hours for the first method. The products were comparable with cellulose acetate in viscosity. The best swelling treatment was the application of 90 per cent. formic acid to oven-dry starch. C.

**Potato Starch: Composition.** M. Samec, V. Pirkmajer, J. Počkar, T. Serneck and L. Žagar. *Österr. Chem.-Ztg.*, 1941, 44, 154-160 (through *Chem. Zentr.*, 1941, ii, 2687 and *Chem. Abstr.*, 1944, 38, 2232<sup>b</sup>). Viscosity measurements of the erythroamylose, electrical conductivity of amylopectin solutions, splitting of phosphoric acid from the latter, and studies of the nitrogen-containing compounds of starch grains, together with previous work, show that potato starch is a compound of amylose and erythroamylose. The latter is bound to phosphoric acid in the gel phase. This fraction separates after splitting the glucose chain which only the erythroamylose possesses. C.

**Wheat Starch: Production.** R. L. Slotter and C. T. Langford. *Ind. Eng. Chem.*, 1944, 36, 404-408. An account is given of the development of a process for extracting starch and other products from whole wheat kernel, which is analogous to the process used in the wet milling of corn. Operating data are given for typical runs in a pilot plant. Yields as high as 80 per cent. of the starch contained in the grain can be obtained. The starch obtained is of better colour, contains less protein, and gives more viscous pastes than the average commercial wheat starch at present available. It is an excellent raw material for the production of syrups and sugars. Good starch can be extracted from wheat that is unsuitable for food. C.

**Sericin: Denaturation.** Z. Hirose. *J. Agr. Chem. Soc. Japan, Bull.*, 1940, 16, 176-179 (through *Chem. Zentr.*, 1941, i, 3313 and *Chem. Abstr.*, 1944, 38, 2214<sup>g</sup>). The preparation and isolation of  $\alpha_{3,8}$ -sericin,  $\alpha_{4,4}$ -sericin and  $\alpha_1$ -sericin are described. The  $\alpha_{4,4}$ - and  $\alpha_1$ -sericins absorb more acid dyes and tannin, combine with more iodine and contain more aromatic acids and tryptophan than  $\alpha_{3,8}$ -sericin, whilst the latter absorbs more basic dyes. The isoelectric point for  $\alpha_{4,4}$ -sericin lies at 3.7-3.8, that of  $\alpha_1$ -sericin near 4.2. When  $\alpha$ -sericin is treated with hot water, an insoluble portion,  $\alpha_1$ -sericin, is formed, and the



isoelectric point is shifted more to the alkaline side than for the initial material.

C.

**Sericin: Properties.** D. Cagnoni. *Seta*, 1941, 47, 230-231 (through *Chem. Zentr.*, 1941, ii, 2511 and *Chem. Abstr.*, 1944, 38, 2214<sup>2</sup>). Cocoons dried at 70-80° were extracted in metal vessels at 118°. The solution was evaporated to dryness in a desiccator under a current of air. The sericin was obtained in the form of brittle flakes, which were white or yellowish, depending upon the strain used. For more accurate examination a 1 per cent. solution was prepared at 110° and the time required for gelling this solution at 6° was determined. The viscosity of the gelled solution was also determined. Tables are given in the original paper.

**Zein Solvents: Critical Peptization Temperatures.** C. D. Evans and R. H. Manley. *Ind. Eng. Chem.*, 1944, 36, 408-410. Solvents for zein are classified broadly into (a) primary solvents, such as various acids, amines, amides and hydroxides, which are capable in themselves of dispersing zein, (b) secondary solvents, such as chloroform, nitromethane, formaldehyde, acetoacetic ester, benzene and toluene, which are not themselves solvents, but may assist primary solvents in mixtures, and (c) indifferent diluents, e.g. hexane, ether and ethyl acetate. Ternary mixtures are discussed and trilinear diagrams for critical peptization temperatures are presented. Ternary solvent systems for zein composed of acetone, water and formaldehyde are similar in solvent characteristics to ethyl alcohol-water-formaldehyde mixtures, but are distinctly superior in their resistance to gelation. The addition of rosin or shellac to binary solvents, such as alcohol and water, substantially lowers the critical peptization temperatures of zein in these mixtures. The presence of rosin in such systems greatly reduces the tendency of the protein dispersion to set to an irreversible gel. C.

**$\alpha$ -Amino Acids: Ammonia Evolved by Ninhydrin; Determination.** D. A. MacFadyen. *J. Biol. Chem.*, 1944, 153, 507-513. Details are given of a method for the determination of the ammonia evolved from primary  $\alpha$ -amino groups of amino acids on reaction with ninhydrin. The procedure comprises (1) reaction with ninhydrin in boiling aqueous solution at pH 2.5, (2) removal of the ninhydrin as an insoluble derivative, hydrindantin, (3) transfer of the ammonia to an acid solution by the aeration procedure of Van Slyke and Cullen, and (4) determination of the ammonia in the acid solution by titration or by manometric measurement by the hypobromite method. Results of determinations of amino groups in various compounds by nitrous acid, ninhydrin-carbon dioxide and ninhydrin-ammonia methods are presented. Glycine and alanine yield only 0.86 and 0.90 mole of ammonia by the ninhydrin method, and tryptophane undergoes an anomalous reaction, yielding only 0.34 mole of ammonia. Under the described conditions,  $\beta$ -alanine and  $\alpha$ -glucoseamine are inert to ninhydrin, and urea does not yield ammonia. C.

**$\beta$ -Eleostearic Acid: Autoxidation.** R. W. Brauer and L. T. Steadman. *J. Amer. Chem. Soc.*, 1944, 66, 563-569. An account is given of a method for the study of the autoxidation of fatty acids in liquid solutions by oxygen uptake measurements and by the simultaneous determination of the absorption spectra of the autoxidising solutions. Curves showing the relation between the rate of oxygen uptake of  $\beta$ -eleostearic acid and the initial concentration of the substrate are presented. The spectrographic changes suggest that during the reaction a conjugated diene is formed which in turn undergoes autoxidation. A method of computing the rate of triene destruction from the oxygen uptake curves and the relation between absorbed oxygen and residual intact triene groups is explained. In order to destroy 1 mol. of  $\beta$ -eleostearic acid, slightly less than 0.5 mol. of oxygen is required initially. Consequently, it is assumed that (a) the initial uptake of oxygen by  $\beta$ -eleostearic acid results in a dimerization involving the formation of some C-C bonds and (b) a parasitic polymerization reaction is induced by the peroxides formed in the course of the reaction. The formation of dimeric products in the reaction has been verified by molecular weight determinations. The amount of oxygen taken up can be computed approximately for the early stages of the reaction from the extinction coefficients of the diene and triene bands if the following sequence of reactions is assumed:  $2(-C:C-)_3 + O_2 \rightarrow (-C:C-)_2$  and  $(-C:C-)_2 + O_2 \rightarrow$  (spectrographically inert products capable of taking up 2 mols of oxygen per mol of original  $\beta$ -eleostearic acid). The rate of oxygen absorption by  $\beta$ -eleostearic acid



becomes insignificant after an uptake of 2 mols of oxygen per mol of  $\beta$ -eleostearic acid. This amount of oxygen can be recovered in a dibasic acid which is probably a dimeride of the original acid. Three-fourths of the absorbed oxygen in this product is removed by treatment with alkali. C.

**Stearic and Abietic Acids: Separation.** G. Papps and D. F. Othmer. *Ind. Eng. Chem.*, 1944, 36, 430-434. A method for the separation of the two main components of hydrogenated tall oil, stearic and abietic acids, is described which depends on selective adsorption on activated carbon. An 8 per cent. solution of the hydrogenated oil in a suitable solvent is passed through a glass column containing activated carbon, and after the oil is fixed on the adsorbent, the abietic acid is first washed out by the use of additional fresh solvent, followed by the stearic acid which is preferentially adsorbed. Of 29 solvents studied, 1-nitropropane was found to be the most suitable. For the evaluation of the solvents, adsorption isotherms were determined for pure stearic and abietic acids adsorbed on activated carbon at 35.5° C., and for 50 per cent. mixtures of the two acids. It was found that the types of adsorption isotherms given by pure stearic acid and pure abietic acid in the same solvent are usually similar. For a family of compounds, e.g. aromatic hydrocarbons, nitroparaffins, or aliphatic alcohols, as the molecular weight of the solvents increases, there is a shift of the isotherm with less adsorption and decreasing differences. The individual adsorption isotherms of a compound do not necessarily predict the course of adsorption of a mixture containing the compound, when the same solvent is used. Stearic acid, which is adsorbed to a greater extent in the individual isotherms, is adsorbed to an even greater extent from the solutions of both stearic and abietic acid. The stearic-abietic system, in different solvents, reverses the general rule in adsorption, that unsaturated compounds are preferably adsorbed to saturated ones. Details are given of a modified McNicoll method for the determination of abietic acid in mixtures, based on selective esterification of fatty acids in the presence of  $\beta$ -naphthalenesulphonic acid. C.

**Berndel Filter: Characteristics and Uses.** E. Manegold and C. Böhme. *Kolloid Z.*, 1943, 103, 96-104 (through *Brit. Chem. Physiol. Abstr.*, 1944, C, 53). The Berndel filter, consisting of a bundle of 7<sup>n</sup> or 19<sup>n</sup> glass capillary tubes is described and photo-micrographs are given. The 19<sup>2</sup> and 19<sup>5</sup> filters have been examined from the physico-colloidal viewpoint. The specific gravity, pore volume, the specific transmission for water and for dry and damp gases, the capillary pressure for an air/water surface, and the capillary width distribution curve have been determined. Technical uses of the filter are discussed. The filtration of a dilute suspension of red blood corpuscles with a disc diameter of 0.8  $\mu$ , with a 19<sup>4</sup> filter having a mean pore width of 5.5  $\mu$ , has been investigated. The filter contains spaces which exceed the capillary width in diameter, so that the filter itself cannot be adequately tested. The possible uses of the apparatus in bacteriology, and for the production of foams and emulsions, and as a spinneret for threads are mentioned. C.

**Polyamide Ultracentrifuge Tubes and Cells: Stability.** G. Bergold. *Kolloid Z.*, 1943, 102, 292-293 (through *Brit. Chem. Physiol. Abstr.*, 1944, C, 52). Centrifuge tubes made from three different polyamides (Igamides) are not shattered by fields of 150,000 g. Type A is translucent, sterilisable by heat, stable to most solvents, and only sensitive to phenol, acid amides, concentrated sulphuric acid, and 80 per cent. formic acid. Type B is transparent, sterilisable by heat, and sensitive to organic solvents, but stable to caustic soda and hydrochloric acid up to 2N. Type C is glass clear, not completely stable to heat, and sensitive to organic reagents, but stable to mercuric chloride, caustic soda, and hydrochloric acid up to 2N. The materials can also be used for construction and packing in other parts of the ultra-centrifuge. C.

**Starch Grains: Structure and Swelling Mechanism.** E. Höppler. *Kolloid Z.*, 1942, 101, 305-312 (through *Chem. Abstr.*, 1944, 38, 2232<sup>7</sup>). In the esterification of native potato starch with halogenated fatty acids, sodium glycollates of starch are obtained. The individual components, Na amylocellulose glycollate, Na amylopectin glycollate and Na amylose glycollate are identified by their different solubilities in aqueous methyl alcohol, and can be obtained in pure form. Sodium amylopectin glycollate has valuable colloidal properties and is displacing tragacanth in technical work. The 1 per cent. solution is clear and stable and its viscosity is 1,000 times that of water. Four different types of

structure can be observed in potato-starch grains: (1) pervading fine stratifications without an amylocellulose outer membrane; (2) relatively thick outer membrane and without an inner stratified structure; (3) double outer membranes; and (4) without outer membranes and without stratification, but with radial spherocrystalline structure. The particular structure is reflected in the swelling mechanism of the starch. Exhaustive observations on starch grains from *Dieffenbachia seguine* indicate the apposition growth of the starch grain. C.

**Amyloses: Viscosity and Molecular Weight.** J. F. Foster and R. M. Hixon. *J. Amer. Chem. Soc.*, 1944, 66, 557-560. Results are given of osmotic pressure measurements on solutions of corn and tapioca amylose acetates in chloroform; they lead to molecular weights of 42,000 and 75,000, respectively, corresponding to 260 and 460 glucose units. Results of measurements of the viscosities of solutions of corn, tapioca and potato amylose acetates in chloroform are shown graphically. These results and data for other members of the series indicate a dependence of the intrinsic viscosity on a power of the molecular weight greater than unity, confirming expectations from the comparative rigidity of Fischer-Hirschfelder models of amylose. The rigidity of acetylated amylose molecules in chloroform appears to be the same as that of amylose in ethylenediamine. C.

**Potato and Sweet-potato Starches: Viscosity and Microscopical Properties.** H. N. Barham, J. A. Wagoner, B. M. Williams and G. N. Reed. *J. Agric. Res.*, 1944, 68, 331-345. Varietal and environmental differences in potatoes and sweet-potatoes are reflected in viscosity, gelatinisation temperature, granule size, and granule size frequency measurements of the starches obtained from them. There is no direct correlation of the granule size and granule size frequencies, as affected by such differences, with either the viscosity or the gelatinisation temperature, nor are the gelatinisation temperature and viscosity directly related. It may be assumed that varietal and environmental factors in some manner affect the structure of the starch granule. The gelatinisation temperature, based on the loss of anisotropy, does not necessarily correspond to that part of the viscosity curve between zero viscosity and the initial maximum. Five hundred granules seem to be a sufficient number to count in order to obtain the average size and the size frequency. A smaller number than this does not always permit a reliable statistical treatment. Curing of the sweet-potatoes lowers the gelatinisation temperature, the granule size, and the viscosity of the starches, indicating a change in the nature of the granule during the curing. The late harvest of potatoes tends to raise the gelatinisation temperature and to decrease the viscosity, but the average size of the granules is either smaller or larger, depending upon the variety. The Warba variety of potatoes and the Little Stem Jersey variety of sweet-potatoes formed the most viscous pastes and the ones that thinned out least during cooking. Starches obtained from Kansas potatoes and sweet-potatoes are of good quality and are the equal of commercial starches if, in the case of potato starch, the basis for comparison is extracted starch. C.

**Potato Starch Grains: Optical Properties.** H. Speich. *Ber. schweiz. botan. Ges.*, 1942, 52, 175-214 (through *Chem. Abstr.*, 1944, 38, 2233<sup>3</sup>). The degree of swelling of potato starch grains that had been carefully dried over phosphorus pentoxide was determined when dispersed in 28 different liquids. Volume changes varied from 68.88 per cent. increase in glycol to 7.2 per cent. decrease in salicylaldehyde. For water the increase was 57.99 per cent. In general the more hydrophilic the liquid, the greater the swelling and the more lipophilic, the less the swelling of the starch grains. According to birefringence determinations, potato starch grains behave toward water, water-alcohol mixtures, alcohols and aldehydes as permeable aggregates of small rods, whilst toward lipophilic (non-polar) liquids, they appear to possess homogeneous sub-microscopic structures. Differences of birefringence can be demonstrated in different parts of the grains (0.0134 whole grain; 0.0124 periphery). For a wave length of 589 m $\mu$  and temperature of 25° the refractive index is 1.535 in the direction of the optical axis and 1.535 at right angles to it. Relative to temperature effects on refraction, the behaviour of the starch grains is between that of solid and liquid bodies. X-Ray diagrams of the carefully dried starch grains show no well defined crystal lattice structure, but a less well organised molecular frame-work. One of the 13 tables that are included compares the optical properties of potato starch grains with those of cellulose from ramie fibres. C.

**Flow Meters: Design.** H. Ziebolz. *Rev. Sci. Instruments*, 1944, 15, 80-87. The variables entering into the flow measurement problem are analysed and basic solutions are studied in relation to the design of flow meters. Various types of instruments are critically discussed. C.

**Geon Resins: Characteristics.** B.F. Goodrich Co. *Rev. Sci. Instruments*, 1944, 15, 136. Geon resins are thermoplastic and of two chemical types. Geon 100 series are special polymers of vinyl chloride characterised by thermal and light stability, toughness and chemical inertness. Geon 101 is designed for electrical applications and Geon 102 for general service. The vinyl chloride: vinylidene chloride copolymers of the Geon 200 series combine increased solubility and thermoplasticity with exceptional stability, chemical resistance and wide useful temperature range. They are unusually stable to light and to thermal decomposition and, in the field of vinyl chloride copolymers, their resistance to hydrolysis by boiling water and hot alkalis is outstanding. Geon resins can be modified by formulation to compositions varying in properties from a rigid thermoplastic, through an elastomeric range, to a very soft jelly. Outstanding in the elastomeric range are the combinations of rubberlike properties with non-flammability and resistance to oxidation. In comparison with other vinyl thermoplastics, compositions of the 100 series Geons are characterised by their resistance to deformation at elevated temperatures. Applications of Geon resins and plastics include insulation and protective jackets for wire and cable, extruded tubing, gaskets and packing, moulded products, protective coatings, and coated fabrics and papers. C.

**Plastacele: Properties.** E. I. Du Pont de Nemours & Co. Inc. *Rev. Sci. Instruments*, 1944, 15, 136. Plastacele, a cellulose acetate plastic for transparent enclosures, windows, shields and partitions, is produced in colourless sheets from 0.020 in. to 0.250 in. and in maximum dimensions of 21 × 51 ins. It is also made in transparent, translucent, and opaque colours. Its surface hardness is comparable to that of aluminium and copper and it can be scratched by materials which will scratch these metals. It can be fabricated by procedures which are in many respects similar to those used for wood, soft metals and other plastics, such as Lucite methyl methacrylate resin. Machinability is improved by conditioning for at least 24 hours at 80-90° F. and about 55 per cent. R.H. A strong blast of air directed at the point of contact of the tool and the plastic will usually suffice to dissipate the heat generated during machining and will at the same time remove chips and shavings from the work. Plastacele can be bent or formed into simple or complex shapes by preheating to a temperature between 250° and 275° F. A table is given showing the general physical properties of Plastacele C-7517-Transparent-Aircraft Grade. C.

**Silkworm: Urea Content.** G. D. Bottero. *Arch. ist. biochim. ital.*, 1940, 12, 199-208 (through *Chem. Zentr.*, 1941, ii, 2965 and *Chem. Abstr.*, 1944, 38, 2397<sup>2</sup>). During larval development of the silkworm (*Bombyx mori*) there is a continuous rise in urea content, reaching a maximum at the time of the resting stage and decreasing to a very low level after moulting. A similar decrease in the urea content was observed also after the greatest growth rate had been achieved at the time of maturity. Each time the silkworm enters a stage of morphogenetic activity it frees itself from the urea accumulated during the development period either by excretion or by enzymic decomposition. The blood of such organisms reveals *in vitro* urease activity. C.

**Iron: Determination with o-Phenanthroline.** S. L. Bandemer and P. J. Schaible. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 317-319. For the determination of iron in organic materials by the o-phenanthroline method the ashed materials are dissolved in dilute hydrochloric acid, sodium acetate is added to aliquot parts to adjust the pH to 3.5, followed by hydroquinone to reduce the iron, and o-phenanthroline to develop an orange-pink colour which is evaluated by means of a photometer using a Corning No. 430 blue-green filter. A critical study of this method has shown that sodium citrate is more satisfactory than the acetate for adjusting the pH. If the pH is adjusted before the introduction of o-phenanthroline, the rate of colour development is influenced by such factors as the time interval between the addition of reagents, temperature of the solutions, type and amount of phosphate present, amount of citrate, and length of time the solutions stand before the photometer reading. If the sodium citrate is added after the hydroquinone and o-phenanthroline at tem-

peratures above 20° C., these factors do not adversely affect the recovery of iron. Under these conditions, maximum colour is developed when the solutions stand only 30 min. For samples of similar materials of approximately the same size, it is expedient to use an average volume of citrate rather than to titrate each sample individually. A modified procedure for the *o*-phenanthroline determination of iron, incorporating improvements suggested by the results of this study, is described. C.

**Tin: Colorimetric Determination.** I. Baker, M. Miller and R. S. Gibbs. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 269-271. A rapid and accurate method for the determination of tin in concentrations ranging from 0.0005 to 0.5 per cent. depends on the development of a blue colour when chlorostannous acid reacts with a silicomolybdate reagent. The tin is separated from an acid solution of the sample by distillation and the distillate used for the colorimetric determination. Micro- and macro-procedures are described. The effects of various ions are discussed, and results of determinations on samples of steel and bronze containing known quantities of tin are presented. C.

**Coloured Materials: Potentiometric Acidity Determination.** L. Lykken, P. Porter, H. D. Ruliffson and F. D. Tuemmler. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 219-234. Potentiometric methods for the determination of free and combined acidity of materials soluble only in non-aqueous solvents are presented; they are particularly applicable to highly coloured or opaque materials such as used lubricants or lubricants containing various additives, and asphalt, emulsions, resins, etc. The free acidity, or basicity, is determined by titrating the sample in a benzene-isopropyl alcohol solution, using a glass-calomel electrode system. The combined acidity is similarly determined by potentiometric titration with alcoholic acid after saponifying the sample dissolved in benzene and isopropyl alcohol containing an excess of strong base. Inflection points and fixed cell potentials are used for the estimation of end points. The determination by a single titration of two or more components of a mixture of acids or bases not distinguishable in an aqueous titration, and phenomena which make possible the estimation of ionisation constants of acids and bases having limited solubility in water, are briefly described. C.

**Leuco Crystal Violet: Spectrophotometric Determination.** W. Seaman, A. R. Norton, J. T. Woods and J. J. Hugonet. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 336-339. Details are given of a method of determining leuco crystal violet by oxidising with benzoyl peroxide and measuring, with a spectrophotometer, the intensity of the colour produced. The standard deviation for a single value is  $\pm 0.25$  per cent. of the total leuco crystal violet. The effect of impurities upon the accuracy is discussed. C.

**Oils: Fluorocolorimetric Determination.** H. Benjamin. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 331. For the determination of the concentration of sulphurized cutting oils blended with straight mineral oil ultra-violet rays were supplied by a bank of four 2-watt argon bulbs, the visible rays being filtered by a Wratten ultra-violet ray filter. Strips of blotting paper were impregnated with standard samples of the oils made up to definite concentrations and these, because of the fluorescent nature of the oil itself, produced a sharp gradation of colours. Samples were then matched to the standards. As the concentrations of the various blends could be related graphically to the viscosity, it was only necessary, when desired, to refer to an appropriate curve to express the fluorescent-colorimetric determination in terms of Saybolt seconds. To determine concentrations of oil in oil-water emulsions, samples of known oil concentrations were prepared and the unknown sample compared with them. In order to remove interfering materials the tests were carried out with ether extracts of the emulsion samples and standards. Oils and waxes which do not fluoresce can be determined in a similar manner by adding suitable oil-soluble fluorescent dyes. Ultra-violet light can be used to detect traces of oil on metal parts after cleaning. C.

**Cotton Cellulose: Deposition.** W. Wergin. *Planta*, 1942, 32, 535-546 (through *Chem. Zentr.*, 1942, ii, 2042 and *Chem. Abstr.*, 1944, 38, 2361<sup>7</sup>). The colourless particles that appear in the cytoplasm of cotton hairs are not cellulose structures from which the fibrils are formed by linear extension as stated by Farr, but plastids in which by special treatment starch can be demonstrated. Microscopy also shows that these plastids are not in contact with the fibrils as

if the better to be incorporated into the cell walls; it is more likely that the formation of cellulose takes place at the walls. C.

**Sodium Stearate and Palmitate Crystals: Production.** A. de Bretteville, Jr. *J. Phys. Chem.*, 1944, 48, 154-158. Sodium stearate can be crystallised only at a critical concentration below the gel point in an alcohol solution. Sodium palmitate cannot be crystallised below the gel point, but does give crystals on the addition of a pinch of sodium chloride, which appears to act as a nucleus for crystal growth. The preparation and habit of single crystals of Na stearate and palmitate are described. Photographs are reproduced. C.

**Sulphite Waste Liquor: Ultrachromatographic Adsorption.** G. A. Schröter. *Papier-Fabr. Wochbl. Papierfabr.*, 1943, No. 2, 50-54 (through *Chem. Abstr.*, 1944, 38, 2486<sup>9</sup>). Pure glucose and xylose were slightly adsorbed by Floridin XXF from aqueous solution, but only the former was sorbed to a slight extent from a spruce waste sulphite liquor diluted 1:10, the reducing value dropping from 0.23 to 0.21 per cent. Filtrates from Floridin XXF showed a pale blue fluorescence in ultra-violet light. When filtered through Frankonit K1, the diluted sulphite liquor yielded a sulphur fraction that showed a very weak blue fluorescence and which, although giving a positive tryptaflavin reaction, gave no test with  $\beta$ -naphthylamine-hydrochloric acid; this indicated the possible presence of a non-fluorescent  $\beta$ -lignosulphonic acid. After passage of the sulphite liquor and rinsing with water, a substance with violet fluorescence was obtained from Frankonit K1. The fraction that contained sulphur was converted into a barium salt containing about C 38.4, H 4.1, S 7.8, MeO 9.1 and Ba 21.5 per cent. which, however, was not homogeneous. When a beechwood sulphite waste liquor was passed through aluminium oxide (buffered to pH 5), several ultra-violet fluorescent zones were noted, one of which was intensely yellow. By extraction from the aluminium oxide with 2 per cent. ammonium hydroxide, the substance responsible for this yellow fluorescence was isolated as a compound high in ash, containing nitrogen and about 1.6 per cent. sulphur. However, this appears to be a secondary product of beechwood sulphite waste liquor since a sulphite waste liquor made from beechwood in the laboratory at first showed a pure violet fluorescence, but on heating to 135° for 2 hours, also gave yellow fluorescing zones when passed through aluminium oxide. When the spruce waste sulphite liquor was passed through aluminium oxide several strongly fluorescing zones formed. One of these (very strongly sorbed) initially showed an intense white-blue-violet fluorescence which disappeared on contact with sulphur dioxide, but returned on rinsing with water. Similar reactions and sorption were noted with a calcium lignosulphonate that had been precipitated by alcohol from spruce waste sulphite liquor. However, these reactions are not proof that the original fluorescing material was actually a lignosulphonate. Aluminium oxide adsorbs very little reducing sugar from spruce waste sulphite liquor. C.

**Wood: Reaction with Diazo Compounds.** F. Schütz and P. Sarten. *Cellulose-chemie*, 1943, 21, 35-48 (through *Chem. Abstr.*, 1944, 38, 2483<sup>7</sup>). Wood is not coloured by diazo compounds, but alkali-treated wood, alkali lignin, phenol lignin and lignosulphonic acid give a red coloration and glucose and other aliphatic and aromatic aldehydes give intensive red colours. An investigation of the reaction between wood and diazo compounds shows that no normal coupling products are formed as with phenols, amines, etc., but oxidation takes place. Details are given of investigations of the products formed by reaction of diazo compounds with wood, glucose and acetic acid lignin, and of the effects of heating air-dried wood at 120.5°, and extracting wood with hot water, alcohol, acetone, etc. The results support the view that lignin is not an original wood component, but a reaction product of the wood lower in water and therefore higher in carbon content. The economic prospects of an extraction of wood with water before pulping and the utilisation of the extracts are discussed. C.

**Wetting Liquids: Contact Angles and Adsorption.** H. K. Livingston. *J. Phys. Chem.*, 1944, 48, 120-124. Available experimental data for solid-liquid-vapour systems are quoted and it is pointed out that for most two-component solid-liquid-vapour systems the contact angle is zero ( $\theta=0$ ) and the solid surface is completely covered with adsorbed molecules from the vapour at saturation pressure ( $\sigma=1$ ). This is in agreement with the equation of Doss and Rao (1938)

$\cos \theta = 2\sigma - 1$ . The derivation of this equation from theoretical considerations is explained. There are no experimental data, however, with which to compare the equation when  $\theta$  is greater than 0 or  $\sigma$  less than 1. C.

## 10—ECONOMICS

**British Cotton Industry: Reorganisation.** The Cotton Board. *Textile Weekly*, 1944, 34, 138-142. A statement on the advantages of amalgamations between firms in the various sections of the cotton trade, and on the extent to which such integration already exists. In spinning, more than half the capacity of the mills is controlled by 31 firms, but in weaving the proportion of small firms is very much larger. In finishing, there are many small concerns, but also a few very large concerns. In the merchant converting section, about 15 per cent. of the total trade is in the hands of the largest ten firms, but the export trade is more concentrated, the largest ten firms controlling 25 per cent. of the business. Only 18 per cent. of spindles and looms are controlled by "vertical" firms. C.

**Textile Wholesale Prices, June, 1944.** *Bd. Trade J.*, 1944, 150, 265. The wholesale price index numbers for June are Cotton, 159.3, Wool 184.0, Other textiles 134.6. C.

**Rayon, Cotton and Wool: Cost of Production.** "*Times*" *Trade and Engineering*, 1944, 55, 43. In 1939 the raw materials for 100 tons of viscose rayon would have cost £2,846 (wood pulp £2,527, sulphur £319). For 100 tons of acetate rayon the costs would have been £1,827 for imported linters, £1,462 for molasses and £72 for sulphur; total £3,361. The corresponding costs for cotton would have been £6,299 and for wool £15,493. C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Benzole Workers: Poisoning and Control.** R. M. Watrous. *Ind. Med.*, 1943, 12, 721-723 (through *Bull. Hygiene*, 1944, 19, 366). Periodical blood counts are the only safe way of controlling the risk of benzole poisoning. The author has organised a method for carrying out such periodical examinations. First he determines the limits of the normal blood picture; depression of the bone marrow is indicated by either a white cell count below 5,000, or a red cell count below 3,000,000, or polynuclear cells below 30 per cent., or any immature or abnormal red or white cells. Next he places the names of the exposed workers on a list, and enters each monthly examination against the particular name, using a black spot if normal, a blue if suspicious, and red if abnormal. A glance at this list shows whether an undue number of blue and red marks occurs for any month, whether the examinations are being made regularly, and the past blood picture of any individual man. In three years five cases of incipient bone marrow failure were detected; all the patients recovered on removal from contact with the poison. Such removals stimulated superior officers to find and remedy benzole hazards formerly considered unimportant; hence there has not been a single red mark on the list for the year. C.

**Carbon Tetrachloride: Toxic Symptoms.** Alice Stewart and L. J. Witts. *Brit. J. Ind. Med.*, 1944, 1, No. 1, 11-19 (through *Bull. Hygiene*, 1944, 19, 365). Carbon tetrachloride resembles chloroform in possessing anæsthetic properties when administered in heavy concentrations; under such conditions it may produce fatal results due to narcosis, hepatic necrosis or acute nephritis, but, if the victim survives, little or no permanent damage ensues. A survey is presented of 170 men and women working in varying, but at times heavy, contact with carbon tetrachloride. More than half had been discharged or transferred from their employment on account of symptoms attributed to carbon tetrachloride poisoning. These symptoms, due to sublethal concentrations, are gastrointestinal distress and mental hebetude. Complaints made included vomiting in 122 cases, nausea in 110, diarrhoea in 97, abdominal pain in 78, anorexia in 64, vertigo in 21, and weakness in 12. The blood was carefully examined without disclosing any abnormality; barium meals were given, revealing hyper-tonicity, irregular peristalsis and spasmodic contraction of stomach and intestines, and accelerated passage of the meal. The mental symptoms were

sub-narcotic-lethargy and loss of mental agility. No damage to the eyes was found. When withdrawn from exposure all the patients recovered; but they establish that chronic poisoning due to carbon tetrachloride exists. The mental hebetude is ascribed to action on the cerebral cortex, and the gastro-intestinal symptoms to stimulation of the parasympathetic or inhibition of the sympathetic centres in the hypothalamus. C.

**Carbon Tetrachloride Patient: Treatment with Casein Digest and Methionine.** J. Beattie, P. H. Herbert, C. Wechtel and C. W. Steele. *Brit. Med. J.*, 1944, Feb. 12, 209-211 (through *Bull. Hygiene*, 1944, 19, 365-366). A report is given of a case of acute carbon tetrachloride poisoning, following accidental ingestion of 30-40 c.c., which was successfully treated with methionine. The patient was given 2 g. of *dl*-methionine by mouth and later a casein digest-methionine solution was injected intravenously. The infusion was prepared by dissolving 20 g. of a dried papain-trypsin digest of casein in 600 ml. of distilled water, acidifying the solution, adding 15 g. of *dl*-methionine, boiling and filtering. The final pH was 7.6 and the solution was approximately isotonic. Laboratory investigations, indicating the mode of action of methionine, including estimations of the nitrogen and sulphur balances and partition of the urinary sulphur between oxidised (total sulphate) and unoxidised (neutral) fractions, are reported. It is concluded that no actual destruction of liver tissue took place, but that the cause of liver disturbance induced by carbon tetrachloride is the abnormal metabolism of methionine and related compounds. The administration of methionine is considered to have prevented permanent liver damage. C.

**Colour-blind Textile Workers: Employment.** W. Schweisheimer. *Rayon Textile Monthly*, 1944, 25, 175. Colour blindness is explained in popular language from the medical point of view, and it is conceded that men may be trained to match colours even though they may fail to describe them correctly. Tests of abnormal colour vision are mentioned. C.

**Textile Operatives: Raising Efficiency.** *Textile World*, 1944, 94, No. 4, 89-96. An illustrated account is given of schemes for increasing the efficiency of operatives inaugurated by United States Government departments to meet the problems of labour shortage. The separate schemes are (1) Job relations training, with a six-day course for overseers, sponsored by the War Man-power Commission; (2) the Physical fitness programme of the Federal Security Agency; (3) Aptitude tests due to the War Man-power Commission, and (4) the Organization of labour management committees, as advocated by the War Production Board. C.

**Textile Operatives: Training.** J. H. Groves and H. O. Carlton. *Cotton (U.S.)*, 1944, 108, No. 5, 89-92; No. 6, 101-103. The authors describe a scheme for the training of new operatives now followed in some mills in Georgia, under the guidance of the United States War Man-power Commission and the Department of Industrial Education, Georgia School of Technology. An essential feature is detailed analysis of the job. Thus, spinning is analysed into 28 tasks and doffing into 21. Each of these is the subject of a set lesson-demonstration. The lesson about "Cleaning off the scavenger roller," for example, is shown in outline; it takes 35 minutes. A daily schedule for the first week is drawn up. That for the first day allows for 4 hours of general orientation (explaining the objects, the rules enforced by the management, visiting the various departments, etc.) and 4 hours of actual lessons. The operation of the scheme and its advantages are described. C.

**Weavers and Overlookers: Training.** A. Sumner. *Textile Manufacturer*, 1944, 70, 293, 296. Suggestions are made of topics that might be included in the training of weavers and overlookers, with special emphasis on economic and technical aspects. C.

**Women Loom Tacklers: Selection and Training.** A. C. Wayman. *Textile World*, 1944, 94, No. 4, 97, 120. The writer advocates the training of women to do such jobs as setting weft feelers, adjusting the pick, aligning the reed and shuttle boxes, adjusting warp tension, levelling the shafts, adjusting the shuttle check, testing shuttle tension and so forth. On such a plan two women might work with one man to do the routine work on 120 looms, leaving the man (as "head tackler") to do the heavier or more difficult work. The shuttle shop might be staffed entirely by women. C.



**Assam Handloom Weaving Industry: Improvement.** H. K. Nandi. *Indian Farming* 1943, 4, 620-621. Handloom weaving in Assam is by far the most important, valuable and widespread cottage industry and is next in importance to agriculture. Towels, teapoy covers, table cloths, napkins, dhoti, sari, lunji, riha, mekhaia, chadar, shirtings and suitings of various designs, sheets, bed covers, curtain cloth, bandages, etc., are produced. These products find a local market and are sometimes exported to other provinces. The ordinary Assam hand-woven cloth, though it costs much more than the cloth of the same texture produced by power looms, is appreciated because of its lasting quality and artistic style and design. Reasons for the steady progress of the handloom industry and measures that would encourage further development are outlined. The Department of Industries maintains two weaving schools for the training of students, two emporiums for the supply of looms, accessories, yarns, dyes and chemicals, and 40 peripatetic weaving demonstrators in important centres for training weavers in improved methods of weaving and yarn preparation and for circulating new designs. In addition to cotton weaving, a good deal of silk weaving is done in the province. C.

**Textile Mill Time Studies: Conduct.** Osbert Hughes. *Cotton* (U.S.), 1944, 108, No. 3, 90-93. Practical hints are given on the purposes and conduct of time studies of textile operations. For the purpose of fixing a normal rate of production it is not advisable to do a limited number of observations on an "average" operative but to assess the "speed rating" of a number of operatives and correct the observed times to one standard. Thus, if in the considered opinion of the observer an operative is rated as, say, a "105 per center," the observed times for her tasks would be multiplied by 105/100. These corrected times are then averaged over a number of operatives (weighted means are recommended) and the results are posted on a sheet called the "Master Element Summary." As an example, the sheet for the task of creeling one bobbin of roving is reproduced. This bears the machine and other spinning particulars and a summary of the various time studies; the final average—or "selected standard time" for the job—is 0.444 minute. C.

**Park High School, S. Carolina: Organisation.** Loui Greet. *Cotton* (U.S.), 1944, 108, No. 3, 87-9, 116; No. 4, 106-108. An illustrated account is given of the development in the Parker School District, Greenville, S. Carolina, of textile training at the High School and of courses for adult operatives. C.

**Textile Industries: Educational Reconstruction.** G. D. H. Cole. *J. Textile Inst.*, 1944, 35, P51-60. C.

**United States National Bureau of Standards: Textile Activities.** W. D. Appel. *Amer. Dyes. Rept.*, 1944, 33, 182-184. A report of an address on the general functions and organisation of the National Bureau of Standards and its special work in the fields of textile testing and standardisation. C.

**Institute of Textile Technology: Organisation.** *Textile World*, 1944, 94, No. 5, 113. A list is given of the officials and trustees of a new Institute of Textile Technology, established at Charlottesville, Virginia, U.S.A. The plan is to accept 15 science graduates each year and train them in textile research at the feet of 7 or 8 teachers who are recognised textile technologists and scientific workers. Specific researches will be undertaken for members on a "cost plus" basis. The Institute will maintain a library, and issue a monthly digest of the literature and a quarterly research bulletin. C.

**Colour and Eye Strain.** F. Birren. *Ldy. & Dry Cleaning J. of Canada*, 1944, June, 20, 32. Eye strain is stated to be responsible for general deterioration in health and consequently in output and sometimes it may lead to serious bodily complaints. Colour can play a very important part in the relief of eye strain in industry and there is room for considerable research to find the ideal conditions for comfort and production. La.



# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL

**Wild Silk Cocoon: Processing.** N. S. Simonov. *Tekstil. Prom.*, 1941, No. 5, 41-44 (through *Chem. Zentr.*, 1943, i, 230 and *Chem. Abstr.*, 1944, 38, 3138<sup>s</sup>). The wild silk worm, *Antheraea pernyi*, is cultivated in the oak forests in various sections of the U.S.S.R. Details of the treatment of the cocoons are discussed.

C.

**What Should a Sire's Wool Look Like?** E. H. B. Lefroy. *Pastoral Rev.*, 1944, 54, 196-197. Observations are made on the fineness and crimp of the merino staple.

W.

**Merino Sheep: Future.** *Pastoral Rev.*, 1944, 54, 195-196. A discussion of threats to the future of the merino, local dangers in Australia being the long-distance one of closer settlement of land, and the immediate one of losses due to the blowfly. The chemical production of synthetic fibres is the newest and most threatening danger to wool of all types.

W.

**Wool Classing: Evils of Over-classing.** "Jason." *Pastoral Rev.*, 1944, 54, 76-78. The tendency to make too many grades in classing has been stimulated by the fact that under the current Imperial Purchase Scheme the Table of Limits has been extended to 3,000 types of wool.

W.

**The Auchenia of South America.** E. Mascheroni. *Internat. Rev. Agric.*, 1941, 32, 134T-142T (through *Animal Breeding Abs.*, 1944, 12, 97). The habitats and economic uses of the llama, alpaca, vicuna, guanaco and their chief cross-breeds are described, and details given of fleece characteristics.

W.

#### (C)—VEGETABLE

**Punjab-American 4F Cotton: Effect of Irrigation.** M. Afzal. *Indian J. Agric. Sci.*, 1943, 13, 357-367. An account is given of investigations of the effects of seven different types of irrigation on the field behaviour and quality of Punjab-American 4F cotton. Flowers and bolls produced per plant were not correlated with the quantity of water given to the crop but, in general, the yield was correlated with watering. Ridging gave indifferent results compared with flat sowing. Application of more water during the growing period is likely to improve, to a small extent, the mean fibre length. The amount of irrigation applied to the crop did not produce any significant effect on either the mean fibre weight per inch or the standard hair weight of this cotton. The percentage of mature hairs showed a tendency to increase with the amount of water applied to the crop. The spinning performance of the cotton showed a small tendency to improve as more water was given to the crop.

C.

**Punjab-American 289F/43 Cotton: Variations in Quality.** S. Rajaraman and M. Afzal. *Indian J. Agric. Sci.*, 1943, 13, 349-356. To study the effect of date of sowing on the quality of lint of Punjab-American 289F/43, sowings were carried out in 1937 in randomized blocks with seven replications. The dates of sowing were: (1) 15 April, (2) 5 May, (3) 20 May, (4) 4 June and (5) 1 July. The third and fourth sowings were within the range of general agricultural practice, the second was slightly earlier, the first too early and the fifth too late. The lint produced in each of the sowings was tested for mean fibre length, modal length, fibre-length irregularity, mean fibre weight per unit length, percentage of mature fibres, and highest standard warp counts. The second, third and fourth sowings yielded lint of the same quality and definitely better than that from the first sowing. The pickings from the fifth sowing were on the

whole similar in quality to corresponding pickings from the second, third and fourth sowings, but the lower percentage of mature fibres and consequent nepiness would detract from the quality of the yarn. Variations in lint quality with progressive pickings were also observed. C.

**Sea Island Cotton: Cultivation in U.S.A. (Georgia).** J. G. Jenkins. *Georgia Coastal Plain Sta. Bul.*, 33, 1942, 21 pp. (through *Exp. Sta. Rec.*, 1943, 88, 188). Cultural and field practices and harvesting, ginning, and boll weevil control methods involved in growing Sea Island cotton are described, with comments on marketing the crop. Emphasis is placed on planting pure seed, its maintenance and distribution, roguing seed fields, and advantages of one-variety communities in maintaining purity. Dosages for seed treatment are recommended, and a home-made treater is illustrated. C.

**Cotton Seeds: Germination; Effects of Soil Disturbance and Fertilizer Placement.** H. P. Smith, M. H. Byrom and H. F. Morris. *Texas Sta. Bul.* 616, 1942, 29 pp. (through *Exp. Sta. Rec.*, 1943, 88, 328). Effects of machine placement of fertilizer and of soil disturbance on the germination of cotton seeds were studied in 1936-40. The best germination and emergence were obtained when seeds were planted on a firm, undisturbed soil, and better stands were obtained with fertilizer placed 2 in. to the sides of the seed and 1 or 2 in. below the seed level. The highest yield was obtained at College Station when fertilizer was placed 2 in. to each side and 1 in. below seed level and at Nacogdoches when fertilizer was placed 2 in. to each side and 2 in. below the seed level, although fertilizer applied in any manner significantly increased yield at both stations. C.

**Boll Weevil: Hibernation, Survival and Emergence.** F. F. Bondy and C. F. Rainwater. *J. Econ. Entomology*, 1942, 35, 495-498 (through *Exp. Sta. Rec.*, 1943, 88, 368). Studies are reported of the factors that influence the abundance of the boll weevil, with particular reference to hibernation, survival, and emergence, conducted in the vicinity of Florence, S.C. They included cage tests, examination of Spanish moss and woods trash, and trap-crop emergence. C.

**Cotton: Ginning; Costs in North Carolina.** S. L. Clement. *North Carolina Sta. Tech. Bul.* 71, 1942, 23 pp. (through *Exp. Sta. Rec.*, 1943, 88, 402). The ginning industry is described. Data for 63 gins for the 1940-1941 season are analysed to show the average cost per bale for different items of ginning expense, the frequency distribution of gins on the basis of average cost per bale, and the relationship of volume of ginning and number of gin stands to ginning costs. The number of active gins in the State declined from 2,625 in 1914 to 824 in 1940, but the number of bales per active gin almost doubled. The average number of saws per gin increased from 80 in 1906 to 211 in 1940. The cost of ginning per bale in the 63 gins studied ranged from \$2.42 to \$6.54, averaging \$3.16. The average costs for different items were: Administration 42 cents., ginning labour 55, repairs and upkeep 18, power and fuel 38, bagging and ties 81, and depreciation 46 cents. Average costs per bale declined as the number of bales increased up to 1,501-2,000 bales. Some relationship was found between ginning costs and the fee charged the grower for ginning. The estimated average receipts per bale from ginning fees, assuming fees were collected for all bales ginned, were \$3.37, being 21 cents in excess of the average costs of ginning. The costs were in excess of the estimated receipts for approximately 43 per cent. of the gins. C.

**South Carolina Ginning Services: Quality.** J. M. Stepp and H. A. White. *South Carolina Sta. Bul.* 344, 1942, 15 pp. (through *Exp. Sta. Rec.*, 1943, 88, 402). Data for 1941 were obtained by a survey of 49 gins located in 20 counties of the State. Some of the findings were: Of 29,392 bales ginned by the 49 gins 8.4 per cent. were reduced one or more grades because of gin damage. Ten per cent. of the gins accounted for 47 per cent. of the gin-damaged cotton, and one-fifth of the gins for two-thirds of the damaged cotton. A high percentage of rough ginning was done in gins operated by merchants and a low percentage in those operated by oil mills. There was no consistent relationship between experience of gin managers and quality of ginning. Experience of the ginner and quality of ginning were related. The gins with the highest and lowest volumes of output had the lowest percentage of gin damage. In general, there was a relationship between, age of gin

stands and quality of ginning. Gins with driers usually did the better ginning. The relationship between cleaning equipment and quality of ginning was not so obvious. C.

**Indian Sunn-hemp: Production; Processing and Grading.** N. Das and B. P. Bhargava. *Indian Farming*, 1943, 4, 505-507. The plant *Crotalaria juncea*, from the stems of which the sunn-hemp fibre is extracted, is a shrubby annual, usually about 4-7 ft. high. The plants are either pulled out by the roots or the stems cut close to the ground. They are then stripped of leaves, tied in bundles and subjected to retting. After retting the fibre is extracted by various methods. Further processing consists either in simply cleaning the fibre by striking bundles against wooden boards fitted with long iron spikes or in dressing or hackling. The several types of sunn-hemp grown in different parts of India show differences in respect of colour, strength, length of fibre, extent of tangling, amount of impurities, etc., and are marketed under a number of trade descriptions. The annual yield of fibre is roughly estimated at 80,000 to 100,000 tons. The fibre finds considerable use in the villages for cordage, mats, etc., and is also exported. Figures are given showing the vicissitudes of the export trade during the last 20 years. Recommendations for improving the quality of Indian sunn-hemp and Government Grading and Marking Rules are outlined. C.

**Mulberry Fibre: Characteristics.** H. Höfer. *Faserforschung*, 1941, 15, 49-77 (through *Chem. Zentr.*, 1943, i, 230 and *Chem. Abstr.*, 1944, 38, 3135<sup>3</sup>). *Morus alba* is important as an additional source of raw material for the textile industry. The fibre is equal in many respects to cotton, and superior in some respects. It is white and soft, and has a silky feel and good strength; average length is 2.5 cm. Technological problems of recovering this fibre from the plant have not yet been solved completely. C.

#### (D)—ARTIFICIAL

**Casein: World Supplies.** *Silk & Rayon*, 1944, 18, 999. The prospects of adequate supplies of casein for rayon after the war are reviewed and held to be very uncertain. Production and export figures for 1935-1938 are tabulated. They show that exports were declining in all countries but the Netherlands. C.

**Cellulose Pulps: Sources and Preparation.** H. Jentgen. *Kunstseide u. Zellwolle*, 1942, 24, 350-364 (through *Chem. Zentr.*, 1942, ii, 2222 and *Chem. Abstr.*, 1944, 38, 2818<sup>9</sup>). The following sources have come into greater use for pulping: beechwood, fast-growing poplars, straw, potato tops, flax and hemp chaff, reeds, millet, broom, esparto, rice straw, corn stalks and soybean straw. Pulping methods developed in different countries and experiences with them are described. The new Kelheimer method can be made fully continuous. Illustrations of some newer plants are reproduced. C.

**Fish Protein: Behaviour in the Manufacture of Animalized Fibres.** O. Mecheels and K. A. Essig. *Zellwolle, Kunstseide, Seide*, 1941, 46, 167-172 (through *Chem. Zentr.*, 1941, ii, 1231 and *Chem. Abstr.*, 1944, 38, 2825<sup>9</sup>). Fish protein is not uniform in its solubility in alkalis; it is more resistant than casein towards alkali degradation and the action of viscose. The protein is dispersed after some time by the viscose. At a ripening temperature of 25° the protein is degraded by the viscose; at temperatures below 6° such degradation by the viscose could not be detected. A new process is described for sulphiding the alkali-pretreated protein by means of carbon disulphide to effect thorough distribution of the protein in the viscose. The loss of protein during the manufacture of fibre is due to alkali soluble particles that cannot be precipitated by the precipitation bath, to degradation of the protein in the viscose with the formation of non-precipitating products, and to filtration losses resulting from insufficient distribution of the protein. No filtration losses and no degradation by the viscose even at normal ripening temperatures (25°) could be detected with sulphided protein preparations. The lowest protein losses were obtained by the introduction of unhydrolysed proteins into the viscose or by the admixture of sulphonated protein preparations. Tables, photo-micrographs and curves are shown. C.

**Rayon Cellulose: Removal of Pentosans.** E. Lindpaintner. *Textilberichte*, 1942, 23, 229-230 (through *Chem. Abstr.*, 1944, 38, 2819<sup>2</sup>). For rayon manufacture it is recommended that the concentration of residual pentosan of the

cellulose used should be not more than 2-4 per cent., and that there should be present a minimum quantity of low-polymer celluloses of polymerisation degree about 150. The pentosan can be extracted without great loss of yield by the action of cold aqueous 6-10 per cent. caustic soda. The optimum conditions, however, vary considerably, and depend on the strength of the cellulose-pentosan linking, the distribution of the links in the chain system, the polymerisation degree of the celluloses present, and the influence of the structure and morphology of the native fibre; in particular, the time of treatment depends to a considerable extent on the thickness of the fibres treated. Yield and residual pentosan data are presented for a wide range of extraction conditions for bleached pulps made from beech, spruce (sulphite), hemp (sulphate), hop pulp, *Phragmites* reeds, and potato haulm (soda process). Cold refining with alkali after digestion and bleaching is preferable to intensive cooking processes for reduction of pentosan content. C.

**Rayon Liquors: Filtration.** A. Meyer. *Zellwolle, Kunstseide, Seide*, 1941, 46, 172-174 (through *Chem. Zentr.*, 1941, ii, 1231 and *Chem. Abstr.*, 1944, 38, 2818<sup>a</sup>). For rayon and staple fibre manufacture, a fine fibrous acid- and alkali-resisting material suspended in the liquid is caused to build up a filtering layer. It is suitable for the filtration of mercerizing liquors, precipitation baths, after-treatment liquors, etc. C.

**Nylon Yarn: Production and Properties.** G. Loasby. *Chemistry and Industry*, 1944, 282-283. A report of a lecture tracing the history of nylon production, the properties of current nylon yarns, and their winding, sizing, scouring and dyeing. C.

#### PATENTS

**Rayon Staple Liquid Treatment Apparatus.** British Celanese Ltd. B.P. 563,168 of 15/5/1942:3/8/1944 (Conv. 17/5/1941). An apparatus for treating fibrous materials with liquids comprises a trough, a band passing along the bottom of the trough to convey the material, and a roller to compress the band and its load of fibrous material against the bottom of the trough and to allow the compressed material to expand into the liquid medium in the trough. Preferably, after the fibres have been treated for a sufficient time they are carried by the band under a second roller by means of which the liquid is squeezed out as the material emerges from the liquid. The roller or rollers thus provided in the trough may conveniently be adapted to retain the liquid medium in the trough. The band is preferably in the form of an endless apron, perforated to allow the liquid medium to pass through the band and reach the fibres. C.

**Rayon Thread Guiding and Liquid Treatment Apparatus.** Lustrafil Ltd. and S. W. Barker. B.P. 563,296 of 4/1/1943:8/8/1944. A roller device for the guiding and liquid treatment of rayon threads is provided with one or more interrupted ribs or grooves for the purpose of confining each liquid treatment to a definite zone on the roller. Preferably, the interrupted ribs or grooves are disposed at least in pairs, the gaps being spaced diametrically opposite to one another. The interruptions in the ribs may be inclined at an angle to the axis of the roller and may be bevelled or chamfered on one side. The flanges or grooves may have more than one interruption if desired, although normally one will be sufficient. C.

**High-frequency Electric Filament Drying and Crimping Apparatus.** American Viscose Corporation. B.P. 563,440 of 30/3/1943:15/8/1944 (Conv. 10/4/1942). Apparatus for drying, crimping or otherwise treating filamentary material comprises an insulating belt for conveying a layer of fibre, a second belt having a course engaging the upper surface of the layer, means for moving the adjacent courses of the belts at substantially the same velocity and means for subjecting the material between the belts to a high-frequency electric current, supplied to a pair of electrodes, one beneath and the other above the adjacent courses of the belts. Alternatively the second belt may be of electrically conductive material, the high frequency electric current being supplied to the belt and to an electrode beneath the insulating belt. The belts may both be of elastic material, the apparatus comprising a number of pairs of rolls and means for driving each succeeding pair of rolls at a speed of rotation less than that of the preceding pair, whereby the filamentary material is crimped. The apparatus may be enclosed in a substantially gas-tight chamber, means being provided for withdrawing gases and vapours from the chamber. C.

**Alkali-treated Cellulose: Dehydration.** British Celanese Ltd. B.P.563,560 of 16/11/1942:21/8/1944 (Conv. 15/11/1941). Cellulose which has been swollen by treatment with alkali and then washed free from alkali by means of water is dehydrated by removing the water as an azeotropic mixture with an organic compound. In a preferred procedure the swollen cellulose is first pressed or centrifuged to remove most of the water and then distilled with ethyl acetate, nitromethane, propyl or butyl acetates or alcohols. Cellulose which has been treated in this way has an enhanced reactivity and is particularly useful for conversion into cellulose esters. C.

**Rayon Cakes: High-frequency Drying.** G. M. Clark (Radio Corporation of America). B.P.563,590 of 24/11/1942:22/8/1944. A process of drying rayon in cake form comprises subjecting the cake simultaneously to at least a partial vacuum and to the action of a high-frequency electric field. Optimum results are obtained by using a vacuum of about 29 in. of mercury and a frequency of about 25 megacycles. C.

**Rayon Staple Liquid Treatment Apparatus.** American Viscose Corporation. B.P.563,630 of 3/11/1942:23/8/1944 (Conv. 12/11/1941). Apparatus for the liquid treatment of rayon in successive stages comprises perforate means for continuously conveying the material through a path, spray means above the conveyor for applying liquid to the material along one or more portions of the path, means for elevating a portion of the conveyor in advance of and beyond each portion of the path where the liquid is applied to confine the liquid applied and to prevent its flowing along the conveyor, and means, e.g. a suction box, below the conveyor for drawing the liquid through the fibrous material. C.

**Spinneret.** Baker & Co. Inc. (Newark, New Jersey, U.S.A.). B.P.563,648 of 28/8/1942:4/8/1944 (Conv. 26/7/1941). A spinneret is made of an alloy of platinum, rhodium and ruthenium containing 1-15 per cent. Rh and 0.5-10 per cent. Ru. Such a spinneret shows high resistance to abrasion, mechanical deformation by pressure, and chemical attack by viscose and by acid coagulating baths. In addition clogging of the orifices is less than with the usual types of spinnerets. C.

**Viscose: Production.** E. I. Du Pont de Nemours & Co. U.S.P.2,338,196. Cellulose xanthate and caustic soda solution are mixed in the desired proportions and stirred to a slurry. A stream of this slurry is beaten into particles and thrown against an apertured surface until a uniform viscose composition is formed. C.

**Superpolyamides of Stable Viscosity.** H. Kroeper, F. Kohler and K. Wolf (Heidelberg; vested in U.S. Alien Property Custodian). U.S.P.2,338,443. The equimolecular mixture of diamine and dicarboxylic acid for condensation to a superpolyamide contains up to 20 per cent. of the hexamethylenediamine salt of glutaric acid, the main bulk of the dibasic acid being a different acid. The superpolyamide is claimed to be stable in viscosity. C.

**Centrifugal Glass Fibre Spinning Apparatus.** G. von Pазsiczky (Hamburg; vested in U.S. Alien Property Custodian). U.S.P.2,338,473. Apparatus for spinning relatively fine glass fibre comprises a cylindrical receptacle for molten glass, openings through the vertical wall at opposite ends of a diameter, and a gas burner fed at high pressure through the axle, with two branches ending in nozzles in the openings. The receptacle and burner are rotated at high speed and the glass is spun into filaments through the combined action of centrifugal force and the blast from the burner. C.

**Electrostatic Cellulose Acetate Spinning Device.** Eastman Kodak Co. U.S.P.2,338,570. A solution of cellulose acetate in acetone at 40-70° C. is forced through an orifice, 0.035-0.15 mm. diam., in a dielectric material, under the influence of a high tension field. C.

**Lustrous Cellulose Ester Filaments: Production.** Eastman Kodak Co. U.S.P.2,338,641. A solution in a volatile solvent containing 1.5-2.5 per cent. of water and at least 25.5 per cent. of a hydrolyzed cellulose ester (soluble in acetone) containing 1-6 per cent. of saturated fatty acid groups of 3-4 C atoms, the remainder being acetyl, is spun in hot air at a speed of at least 450 metres per minute. The ester is specified as having a viscosity of 30-150 seconds for a solution of 1 part ester to 4 parts acetone. C.

**Skin Wool: Cleansing.** R. Gutensohn (to I.G. Farbenind. A.-G.). D.R.P. 715,441 of 27/11/1941 (through *Chem. Abs.*, 1944, 38, 2218). Skin wool is treated in an acid liquor containing organic acids combined with suitable buffers, condensation products of  $\alpha$ ,  $\beta$ -alkylene oxides and high molecular aliphatic alcohols or alkylphenols and aminocarboxylic acids containing more than 1 carboxyl group in the  $\alpha$ -position of the N. W.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Card Web: Photo-electric Measurement of Irregularity.** A. Varga and N. H. Chamberlain. *J. Textile Inst.*, 1944, 35, T89-92. C.

### (B)—SPINNING AND DOUBLING

**Casablancas Two-zone Drafting System.** F. Wooding. *Textile Weekly*, 1944, 34, 267-270. A drawing is given of a high-draft system with a back zone consisting of two lines of fluted steel bottom rollers and two lines of cushion-covered top rollers and a front zone consisting of the Casablancas "apron-cradle" system. The writer reports favourably on a trial of the system over a period of some weeks, on a Howard and Bullough roving frame with 7-in. lift. The best results were obtained when the draft in the front zone was about four times the draft in the back zone and a slight "creep" draft was secured between the zones. C.

**Rayon Staple: Spinning.** H. Ashton. *Textile Weekly*, 1944, 34, 440, 446. Particulars are given of the commercial limits of count to which various marks of "Fibro" staple can be spun on (a) cotton, (b) worsted, (c) woollen and (d) waste condenser systems, and also of the hank numbers, drafts, speeds and settings recommended at various stages in the production of 32s from 1½-in., 1.5 den., bright "Fibro." Hints are given of the probable influence on machine design of the introduction of "Greenfield tops." C.

**Rings and Travellers: Recent Developments.** D. Eadie. *J. Text. Inst.*, 1944, 35, P65-69. C.

### PATENTS

**Up-twister Throwing Machine Yarn Tensioning Device.** H. Lasch. B.P. 563,241 of 16/10/1942:4/8/1944. In an up-twister throwing machine, the yarn coming from the supply package and flyer is caused to pass through two movable guides arranged to give it a substantial deflection, one of which functions as a balloon guide, the relative positions of the guides (and therefore the amount of deflection in the yarn) being determined by the tension in the yarn against the influence of counter-weight means, increase of tension causing less deflection in the yarn and also resulting in a lowering of the balloon guide so as to shorten the balloon and relieve the tension in the oncoming yarn, whilst decrease of tension has the opposite effect. In a typical machine the usual fixed balloon guide is replaced by a pivotally-mounted balloon guide, and a further pivotally-mounted guide substantially deflects the yarn between the balloon guide and the glass rod, both guides being overbalanced by a common counter-weight, but being capable of yielding under any increased tension of the yarn. The second guide yields to lessen the degree of deflection in the yarn and thus allow a short extra length to go forward to relieve the increased tension in the yarn where it originated, and the balloon guide yields to reduce the tension again, back to normal, by moving towards the supply package. C.

**Nasmith Combing Machine.** G. W. Nasmith, J. I. Nasmith and District Bank Ltd. B.P. 563,282 of 30/10/1942:8/8/1944. In a Nasmith combing machine the usual combing cylinder segment is dispensed with and there is provided a guide plate which rises and falls in a path between the detaching roller position and the combing cylinder cover, the movements of such plate having the necessary synchronism with the movements of the detaching rollers, nipper, and top comb to engage by contact, and thus guide and control, the end of fleece backed off for piecing in and throughout its movements in both directions. The guide plate rises to its uppermost position to receive the end of the fleece as it begins to be backed off, descending with the fleece, then rising therewith and dwelling during the rise until the top comb has commenced to withdraw and then again resuming its uppermost position. The fleece end is

thus never in contact with a surface moving in the opposite direction to itself, and incidentally, the use of the cylinder segment being discarded more effective cover may be provided for the dangerous needles. C.

**Synthetic Rubber Roller Cover.** J. Rockoff (Dayton, Ohio, U.S.A.). B.P. 563,374 of 28/9/1942:11/8/1944. A cot or cover for a roller of a spinning or other textile machine consists of a vulcanized synthetic rubber composed of butadiene-acrylic nitrile co-polymer, a filler, a resin, dibenzyl ether and benzothiazyl disulphide. Cots of this type have a smooth, dry surface, do not develop gumminess on prolonged running and are tough, resilient, and resistant to oxidation, abrasion, and oil. C.

**Draft Roller Gearing Guard.** J. and L. Gleave. B.P.563,693 of 6/4/1943:28/8/1944. A guard for the draft roller gearing of ring spinning frames comprises an arm provided on the starting rod and connected to a catch lever mounted on the spinning frame at one side of the headstock and adapted in one position to secure the hinged guard cover of the gearing at the said side, the lever being tied by a tie bar to a second catch lever mounted on the spinning frame at the opposite side of the headstock and adapted in one position to secure the hinged guard cover of the gearing at the opposite side. Means are provided on the guard covers to prevent movement of the levers in one direction while the covers are open and thereby prevent starting of the ring spinning frame while the covers are open. These means may comprise bent bars secured to the covers and adapted in the open position of the guard covers to lie in the path of the tie bar and thereby prevent the tie bar and therefore the starting rod from rotating into the starting position. C.

**Wet Spinning Machine.** W. Gibson. B.P.563,863 of 5/2/1943:1/9/1944. A spinning, twisting or like machine and especially a wet spinning machine is provided with a spindle to support detachable yarn packages, a yarn laying-on member for traversing the yarn and building the pirn, comprising yarn guiding-on means at its upper edge, a lower part below the guiding-on means rotatably mounted in a bearing for the spindle so that in operation the maximum unsupported length of spindle does not substantially exceed the length of the building traverse, and a recess for accommodating the yarn receiving means in the lower part extending downwardly a sufficient distance from the guiding-on means to permit of laying-on being commenced at the top of the pirn receiving means. The laying-on member comprises an upper part which is preferably of frusto conical shape to accommodate the tapered end of the pirn during the building traverse and has yarn guiding-on means at the upper edge thereof and a lower part which has a pirn tube recess extending down from the cupped part a sufficient distance to permit of laying-on being commenced at the top of the pirn and has an inner cylinder whose outer surface forms the inner surface of the recess and a bearing or guide surface for the pirn tube and whose inner surface forms a bearing means of substantial length for the spindle up to near the level of the guiding-on means. Preferably the pirn tube and spindle have a detachable connection which causes them to rotate together, but which permits the tube and fully formed pirn automatically to be doffed or detached from the spindle and left sitting on the upper or cupped part of the laying-on member when the spindle is lowered to the starting position. C.

**Ring Frame Builder Motion.** Saco-Lowell Shops (U.S.A.). B.P.563,898 of 16/6/1942:5/9/1944 (Conv. 28/8/1941). A builder motion for a ring spinning frame of the kind comprising initial driving means for imparting a straight line motion to a primary element, mechanism for transmitting from the primary element a linear motion to the ring rail, means for reversing the straight line motion imparted to the primary element, two means for determining the positions of the points at which such reversals take place, at least one of such means being progressively adjustable to vary the position of reversal controlled thereby, and power driven mechanism for actuating the adjustable means for varying the position at which reversal takes place while the spinning operation continues is characterised in that adjustable controlling means is provided for the power driven actuating mechanism of the adjustable means such that the extent of the adjustment movement of the adjustable means at each progressive adjustment thereof can be controlled. The con-



trolling means may also be adapted to control the direction of the adjustment movement of the adjustable means. C.

**Air-blast Lap Treatment Apparatus.** Proctor and Schwartz, Inc. U.S.P. 2,338,619. Loose fibre is conveyed on a foraminous belt under a succession of slots through which sheet-like blasts of air are directed against the fibre. Directly under the blast the fibre is compressed against the travelling surface but laterally the fibre is lifted high and opened. C.

**Hollow Spindle Yarn Plying Machine.** Eastman Kodak Co. U.S.P. 2,338,656. The machine combines a rotating hollow spindle, a spool carrying a core thread arranged to pass through the spindle, a supply of low-twist yarn mounted on the spindle, means for plying the two yarns together, an adjustable brake shoe that engages the spool and imposes tension on the core thread, and means for controlling this tension comprising a flange on the spindle having a diameter at least 25 per cent. greater than the maximum diameter of the package of low-twist yarn. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Winding Machines for Doubling Industry.** Universal Winding Co. *Textile Recorder*, 1943, 61, November, 33-35; December, 40, 47; 1944, January, 48-51; February, 48-50; March, 52-55. An illustrated account of modern machines and methods of winding for doubling. (1) Production tables are provided for the No. 50 "Leesona" cheese winding machine. (2) The importance of large package supply is emphasised, single-end and bunch knots are discussed, and single-end and two-end winding are compared. (3) The No. 44 "Leesona" Roto-coner high-speed winding machine for cones and cheeses, and its output are discussed. (4) The "Dual process" of winding by the "Leesona" Roto-coner and No. 60-GF. multiple-end winding machine are described. (5) The Andrew and Langstreth disc doubler is described and an account is given of the "Universal" No. 5-19 machine which is used to feed the doubler. C.

**Yarns: Preparation for Weaving and Knitting.** *Textile Weekly*, 1944, 34, 225-231. Modern practice in warp and weft preparation is summarised in a series of schemes that indicate the various stages from the mule cop or ring bobbin for typical warps and cloths, and mention is made of the special machines in use. C.

#### (B)—SIZING

**Cellulosic Sizes: Application.** C. Müller. *Deut. Textilwirt.*, 1942, 9, No. 15-16, 23-24 (through *Chem. Zentr.*, 1942, ii, 2220 and *Chem. Abstr.*, 1944, 38, 3139<sup>b</sup>). Sizes made from cellulose can be used for all textiles without the addition of fats. Experiments have been made on the use of unsized yarns. Weaving tests are discussed. C.

**Textile Sizes: Properties and Applications.** I. Madlung. *Kleppig's Textil-Z.*, 1943, 46, 160-163 (through *Chem. Zentr.*, 1943, ii, 90-91 and *Chem. Abstr.*, 1944, 38, 3139<sup>b</sup>). Wheat, rice, potato, and corn starches are particularly suitable for cotton; these may contain water-absorbing, antiseptic or weighting agents. The use of the following products is discussed: vegetable and pectin sizes (e.g. Dorma size) as additions to starch; glue, protein degradation products and gelatin for wool, staple fibre and rayon; linseed oil sizes for rayon; various new cellulose derivatives such as Tylose TWA 25 and 600, Tylose MGC, and Tylose KZ<sub>5</sub> and 25 for staple fibre and rayon; and completely synthetic products of the type of Plexileim. Methods of detecting the various kinds of sizes are described. C.

#### (C)—WEAVING

**"Bracewell" Automatic Weft-replenishing Device.** J. H. Strong. *Textile Mercury & Argus*, 1944, III, 221-225. Drawings are reproduced of a weft-replenishing motion that can be fitted readily to the ordinary overpick Lancashire loom and combines the features of shuttle-changing and pirn-changing automatic looms. It comprises a 4-shuttle circular box which rotates a quarter-turn to bring a fresh shuttle into action when required and the empty shuttle is replenished from a pirn magazine. C.



**Butterworth and Dickinson Silk and Rayon Loom.** J. W. Hutchinson. *Silk & Rayon*, 1944, 18, 1002-1003. A brief description is given of the various special features of a 16-shaft negative dobby loom for silk and rayon weaving. C.

**Centre Weft Fork: Maintenance.** *Textile Recorder*, 1944, 61, July, 58-60. Details are given of the working parts of the centre weft fork, their adjustment and advantages. C.

**Double-lift Jacquards: Setting and Timing.** *Silk & Rayon*, 1944, 18, 886-889. A detailed description is given of the head motion and cylinder operation of the Dracup double-lift jacquard and the settings and timings are fully explained. A suitable varnish for the harness bands consists of starch  $2\frac{1}{2}$  lb., glue  $2\frac{1}{2}$  lb., white soap 2 oz. and potassium carbonate 1 oz. to 15 gallons of water. C.

**Jacquard Looms: Application.** H. Hardaker. *Textile Weekly*, 1944, 33, 326-9, 638-640. A broad review of the art of jacquard weaving and the development of the mechanism, with special reference to the single-life jacquard made by Messrs. John T. Hardaker Ltd., Bradford. C.

**Loom: Overlooking.** *Textile Recorder*, 1944, 61, April, 38-40. Practical hints are given on the early detection by the weaver and overlooker of weaving mistakes. C.

**Silk Fabrics: Weaving.** J. W. Hutchinson. *Silk & Rayon*, 1944, 18, 776-777. Practical hints are given on defects in weaving silk, and remedies for them. C.

**Hand- and Power-woven Wool Fabrics.** (1) I.L. *Text. Mfr.*, 1944, 70, 100, 110. (2) G. Appleyard. *ibid.*, 247. (3) I.L. *ibid.*, 247. (1) In an article appraising the difference between hand- and power-woven fabrics (this *J.*, 1943, 34, P133) no mention is made of templing. On the ordinary hand-loom with no take-up motion, variation of picks per inch occurs when using the ordinary hand-loom temples, illustrations of which are given. The softer handle of both warp and weft in hand- as compared with power-woven fabrics is due to the gentler treatment of the yarn in the preparatory processes and to the fly-shuttle picking of the weft. (2) Templing was not used on the hand-loom for the weaving of the experimental fabrics described in this *J.*, 1943, 34, P133. The differences between professional and amateur hand-loom weaving are discussed. (3) Templing is of major importance in hand-loom weaving, the efficiency of its functioning directly influencing the required strength of the beat-up and thus affecting the entire width of the fabric. Professional hand-loom weavers do not necessarily use such mechanical aids as take-up motions, objections to which are listed. W.

**Wool Weaving Machinery.** L. Bellwood. *Text. Weekly*, 1944, 33, 992, 994-996, 34, 18, 20. Present and future problems connected with the efficiency of automatic looms are discussed, with special reference to cloth construction, time lost by stoppages from various causes (warp and weft renewal, cloth removal, loom repairs), measuring and recording weaving efficiency, and the influence of the human factor. W.

#### (G)—FABRICS

**Crêpe Fabrics: Designing.** *Textile Mercury & Argus*, 1944, III, 173-177, 249-250. Practical hints are given on the construction of crêpe fabrics, with point-paper drafts of typical weaves. C.

**Jacquard Fabrics: Designing.** *Textile Weekly*, 1944, 34, 232-235, 272-274, 406-410. The processes of transferring a design to point paper and cutting and lacing the pattern cards are described with details of the mechanism employed. C.

**Laminated Fabric Plastics: Development and Uses.** C. S. Jones. *India-Rubber J.*, 1944, 107, 177-178. A brief review is given of the probable outlets for cotton cloths (4 oz. to 4 lb. per yard), paper, rayon yarns, and carded and combed cotton webs in the manufacture of low-pressure laminates. Problems for investigation are (1) the production of a cotton fabric with minimum warp crimp and capable of stretch in the weft direction only, and (2) the improvement of fabrics for laminates by blending cotton with other fibres, e.g. glass, or by impregnating them with plastics. C.

## PATENTS

**Shuttle Peg Mounting.** C. Allsopp and G. Newsome. B.P.563,217 of 14/1/1943:3/8/1944. The upper side of a shuttle at the butt end of the peg is provided with a recess to receive a trough-shaped or U-shaped piece of metal having a flat base and vertical sides. In the base of the trough there is provided a U-shaped leaf spring, one leg of which rests flatly upon the base of the trough, whilst the other extends normally either parallel to the base or upwardly at a small angle. The shuttle peg is carried by an L-shaped metal block fitted between the walls of the metal trough. Advantages of the device are that the relatively-moving faces of the block and trough are of wear-resistant metal, and that it can be removed from the shuttle as a unit. C.

**Single-course Knitting Machine Conversion Means.** T. Booth. B.P.563,246 of 15/1/1943:4/8/1944. For beret or other knitting machines normally arranged to knit a single course of stitches at each operating stroke, conversion means are provided for knitting a number of courses at each operating stroke. In one embodiment, the means consist essentially of a cam track having a double reciprocating action for the needles and a double yarn guide carrying system with flexibly mounted yarn guides. C.

**Hair Nets: Production.** Byard Manufacturing Co. Ltd. and A. E. Hunter. B.P.563,497 of 19/11/1942:17/8/1944. A tube of openwork net fabric is produced on a twist lace machine and closed at intervals, there being provided a slit between successive closures, the slit being shorter than the distance between the closures, and the mouth of the slit being reinforced by a thicker thread, which is preferably extensible and may comprise a rubber thread or a knitted chain. After removal from the machine the tube is severed across the closed sections, each piece then forming a hair net of open-mouthed bag shape. C.

**Cop Winding Machine.** J. Mackie & Sons Ltd. and J. P. Mackie. B.P.563,549 of 12/4/1943:18/8/1944. In a cop winding machine of the type in which the spindle rotates, but does not move longitudinally, whilst the end of the cop is formed by a conical roller or rollers bearing on the tapered end, the cop being forced along the spindle as it is built up, the yarn is tensioned just as it passes to the nose of the cop by being bent sharply around a yarn tensioning bar disposed between the traversing device and the cop. The spindle is surrounded by a conical or tapering projecting surface just above the point where the nose of the cop being wound thereon will terminate, the projecting surface being such as to assist in preventing the yarn from creeping up over the spindle at the nose end of the cop. C.

**Winding Machine.** J. Mackie & Sons Ltd. and J. P. Mackie. B.P.563,613 of 10/5/1943:22/8/1944. A winding device for cross-winding rolls of yarn comprises the combination with a roller having one or two helical grooves in its surface without intersections for causing the yarn to be traversed either in one direction only, or from an intermediate point toward opposite ends of the roll to be wound, of a stationary yarn guide eye and a shaped breastplate or bar extending lengthwise of the grooved roller, and over which the yarn passes between such yarn guide eye and the grooved roller, the positions of the guide eye and breastplate or bar and the shape of the breastplate or bar being such as to control the whole return travel of the yarn from the leaving end of the groove back toward its starting point, or toward the entering end of an oppositely directed groove in the roller when two oppositely directed helical grooves are provided. The breastplate or bar may be formed with a surface such that over part of the return travel under the pull from the guide eye it retards the return of the yarn and over another part of the return travel it accelerates the return of the yarn, thus tending to make the return traverse of the yarn more uniform. C.

**Winding Machine.** J. Mackie & Sons Ltd. and J. P. Mackie. B.P.563,614 of 10/5/1943:22/8/1944. A winding device for cross-winding rolls of yarn comprises a guide eye for the yarn and a roller having outwardly directed helical grooves with overlapping inner starting ends for effecting the outward traverse of the yarn from an intermediate position, the grooves either having no return portions or short return ends only, the arrangement being such that the pull of the yarn from the guide eye serves to traverse the yarn back from the ends of the roller to the overlapping starting ends of the oppositely directed grooves,

whilst the guide eye is placed in front of the roller in a plane between the overlapping starting ends of the grooves. The pitch of the outwardly directed helical grooves may be varied so that it becomes less towards the outer ends of the traverse. For winding conical rolls the helical grooves are of unequal length, their overlapping ends being nearer to the larger end of the conical roll to be wound. C.

**Asbestos Yarn: Impregnating with Synthetic Resin.** American Cyanamid Co. B.P.563,678 of 30/4/1942:28/8/1944 (Conv. 30/4/1941). A method of increasing the mechanical strength of asbestos yarn comprises impregnating the yarn with a melamine-formaldehyde resin syrup, which can be cured under alkaline conditions, followed by curing of the resin. The resin syrup may contain suitable wetting agents and sizing and softening materials. C.

**Anti-static Yarn Lubricating Agent.** British Nylon Spinners Ltd., G. Loasby and D. L. C. Jackson. B.P.563,725 of 8/1/1943:28/8/1944. Threads, yarns, filaments, etc., which are liable to develop electrostatic charges during processing, e.g. cellulose acetate and nylon threads are treated with a lubricating composition comprising an aqueous solution or emulsion containing 2-10 per cent. by weight of a condensation product or products obtained by the interaction of 2-6 parts by weight of ethylene oxide with one part by weight of a higher fatty alcohol, and 2-10 per cent. of a lubricating oil. C.

**Silk: Softening.** A. F. Burgess (Institute of Paper Chemistry, U.S.A.). B.P. 563,745 of 29/6/1942:29/8/1944. Silk is softened by treatment in an oil emulsion adjusted to a pH preferably between 3.45 and 5.5. The treatment should be carried out at 70-100° F. for about 10-30 min. Preferably the silk is given a preliminary treatment in an acid rinsing bath. The softened silk, preferably after knitting, is subjected to a degumming treatment in a hot bath containing sufficient strong mineral acid and a buffer to maintain the pH at 1.0-2.9. The final finishing or dyeing step may be carried out in an acid medium. C.

**Twist Lace Machine.** Byard Manufacturing Co. Ltd. and A. E. Hunter. B.P.563,902 of 19/11/1942:5/9/1944. A twist lace machine is provided with means whereby across each of predetermined breadths of fabric the speed of take up is greater at the middle than at the sides. In one arrangement the usual porcupine roller is replaced by one or more cam shaped rollers the peripheries of which are displaced from the axis by a greater amount at the middle than at the sides. After passing over the rollers the work is wound on to one or more rollers as desired. In an alternative arrangement the porcupine roller and the cylindrical fabric-receiving roller are dispensed with and the fabric as made passes up the facing bar and is then received on a member mounted to rotate about its axis, the distance of the periphery from the axis being greater at the middle than at the sides. Shaped lengths of fabric or net of a predetermined breadth suitable for making into bag-shaped articles, such as hair nets, slumber caps, etc., can be produced. C.

**Winding Machine Traversing Element.** Abbott Machine Co. U.S.P. 2,338,085. The traversing element for movement adjacent to and lengthwise of a row of holders for winding packages comprises a tube to which yarns are directed from directions such that they bend round the tube in running on to the packages. C.

**Finned Stocking.** F. O. Donner (Chemnitz; vested in the U.S. Alien Property Custodian). U.S.P.2,338,375. A stocking is knitted with a fin-like strip projecting from the back of the leg, to serve as a reliable hold for the fingers of the wearer when pulling on the stocking. C.

**Flat Knitting Frame Yarn Moistening Device.** P. H. Aurich (Chemnitz; vested in the U.S. Alien Property Custodian). U.S.P.2,338,394. The yarn is run off from spools housed in horizontal casings disposed over water in a box, so that it can pick up moisture, there being openings in the top of the box and bottom of the casings. C.

**Flexible Winding Spool.** Industrial Rayon Corporation. U.S.P.2,338,513. The claim is for a tubular spool formed radially with dove-tailed grooves (four are shown) so that it is flexible under grip. C.

**Cord Pads or Mats: Production.** Dow Chemical Co. U.S.P.2,338,610. Cordage is wound on spools at such a ratio of traverse to winding speed that the layers cross at an angle between 15 and 60°, until the desired thickness has been reached. The wound package is then cut through from end to end of the spool and opened out to form a mat. C.

**Dobby Loom Shedding Mechanism.** Leopold Fuchs (North Bergen, N.J.). U.S.P.2,338,633. The claim is for an arrangement of griffe blades and bars and heald-actuating mechanism whereby the warp threads will not pass the centre of the shed at the same time as they are shifted from one line of the shed to the other by the reciprocating movement of the griffe blades. C.

**Webbing Loom Webbing Receptacle.** Thomas French & Sons Ltd., New York. U.S.P.2,338,638. The claim is for means to pass the webbing upwards in front of the loom to a receptacle above the loom. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (A)—PREPARATORY PROCESSES

**Hatter's Fur: Preparation for Felting.** Dyer, 1944, 92, 133-134. A short review of the literature dealing with the theory of carotting, and with mercurial poisoning, followed by a brief survey of recent carotting patents. W.

##### (B)—BOILING, SCOURING, DEGUMMING, AND WASHING

**Rayon Locknit Fabric: Scouring, Dyeing and Finishing.** Silk & Rayon, 1944, 18, 772-5; 992-4. Practical hints are given on economical methods of processing rayon locknit fabrics. C.

**Waste Kier Liquor: Utilisation.** C. C. Downie. *Textile Mercury & Argus*, 1944, 111, 250-253. A general note on the feasibility of recovering alkali from waste kier liquor by treatment in an absorption tower with flue gases. C.

##### (G)—BLEACHING

**Cellulose Hydrate Fibres: Washing and Bleaching.** G. Lietz. *Allg. Text. Z.*, 1943, 1, 48-52 (through *Chem. Zentr.*, 1943, ii, 1512 and *Chem. Abstr.*, 1944, 38, 3136<sup>5</sup>). Cellulose hydrate, its chemistry and structure, fibre-protective washing and fundamental washing operations (wetting of fibre, swelling of fibre and dispersion of the dirt in the bath) are discussed. The treatment should be faintly alkaline, with synthetic washing agents and without scouring. The bleaching agent should be used in the minimum amount necessary for formation of chloramines, or alkali and water should be used sparingly; any residual bleaching ingredients should be removed completely. The bleaching period should be as brief as possible. In the Ce-Es process, without kierung, the goods are impregnated with chlorine and bleached with hydrogen peroxide. C.

**Hypochlorite Solutions: Colorimetric pH Determination.** J. Jensen. *Skand. Tid. Textilind.*, 1942, 40, 71 (through *Chem. Zentr.*, 1942, ii, 1981 and *Chem. Abstr.*, 1944, 38, 3139<sup>5</sup>). Several commercial cellulose acetate films were treated with benzidine (0.5 g. per l. of water at 70°) and the colour reactions (depending on the pH) of alkaline hypochlorite solutions were determined. A small piece of the treated film was agitated for 2 min. below the surface of the solution and washed immediately with water. If the solution was nearly neutral and not too dilute, then the colour became reddish brown after 2 min. With increasing pH values the foil became brownish yellow and then assumed various shades of green; at pH values above 10 it became light blue. Increases in temperature or concentration changed the colour the same way as a decrease of alkalinity. Atmospheric carbon dioxide changed the colour of the water-treated foil. Prolonged exposure to the leaching solution had the same effect; however, in the latter case this change was slower, so that an accurate observation of the time was unnecessary. The blue colour is unstable and disappears when the film is stored for some time. Cotton was bleached with hypochlorite solutions of various concentrations and alkalinities and for various periods. Solutions that produced brown coloration with benzidine-treated films (pH 7.2-8.6) were the most harmful; those giving green coloration (pH 9-10) were effective and less harmful. Tables show the colours for different pH values and concentrations. C.

**Warps: Bleaching.** R. Golbs. *Klepzig's Textil-Z.*, 1942, 45, 613-614 (through *Chem. Zentr.*, 1942, ii, 2751 and *Chem. Abstr.*, 1944, 38, 3140<sup>2</sup>). Practical suggestions are made for bleaching according to the boiling, chlorinating and acid bleaching process, the Griesheim single-bath process, the combination bleaching method with hypochlorite and hydrogen peroxide, and the oxygen bleaching method. C.

#### (H)—MERCERISING

**Mercerisometer.** V. G. Parchomenko. *Tekstil. Prom.*, 1941, No. 4, 47 (through *Chem. Zentr.*, 1942, ii, 2220 and *Chem. Abstr.*, 1944, 38, 3140<sup>1</sup>). An apparatus is described by means of which can be determined (1) the degree of shrinkage of cotton yarn or of finished fabric, (2) the effect of concentrated alkali in the cold on yarn of short, medium and long fibre, and on fibre of different degrees of ripeness, and (3) the degree of shrinkage of yarns of different degrees of twist. C.

**Wool-like Cotton: Production.** A. Lagov. *Tekstil. Prom.*, 1941, No. 2, 49-51 (through *Chem. Zentr.*, 1942, ii, 2220-2221 and *Chem. Abstr.*, 1944, 38, 3138<sup>8</sup>). Mercerised cotton (8 kg.) was wetted with neutral "Kontakt" solution, treated with caustic soda, converted to cloth and then made into suits. The suits looked like woollen suits and after two years' wear were still in excellent condition. C.

#### (I)—DYEING

**N-Anthraquinonyl- $\beta$ -hydroxynaphthamide: Preparation and Use as Coupling Component.** E. Ferber. *Textilberichte*, 1942, 23, 580-600 (through *Chem. Abstr.*, 1944, 38, 3131<sup>7</sup>).  $\beta$ -Aminoanthraquinone (22 g.) and 18 g. of  $\beta$ -hydroxynaphthoic acid were ground fine with a little xylene, stirred into 300 c.c. of xylene, heated slowly to 60°, and 4.5 g. of phosphorus trichloride added. After 1 hour the temperature was raised to the boiling point. After 5-6 hours the evolution of hydrogen chloride stopped. The amide formed was purified with soda solution and hydrochloric acid; yield 81 per cent., m. 298° after crystallisation from nitrobenzene, soluble in pyridine, concentrated sulphuric acid and nitrobenzene and insoluble in water, benzene, toluene and glacial acetic acid. It can be converted to a vat dye readily by treatment with caustic soda and hyposulphite: the vat is dark red, is taken up readily by fibres, becomes dark brown after re-oxidation, and turns golden-yellow after acidification. It is absorbed much better than the usual Naphthol AS compounds and the dyes made by coupling are very fast to boiling. C.

**Orema Dyes: Properties and Application.** E. Krähenbühl. *Textilberichte*, 1943, 24, 315-316 (through *Chem. Abstr.*, 1944, 38, 3129<sup>9</sup>). These products of the Gesellschaft für Chemische Industrie in Basel are pigments of extremely fine state of division forming suspensions that are stable in water for several days. The suspensions are faintly opalescent. They can be fixed completely on the fibres to produce fast dyeings. The Orema printing inks consist of Orema dye, Orema fixing agent and Orema special thickening agent. The washing-fastness depends on temperature and length of heating period. The dyeing operation is described and various Orema products are tabulated. C.

**Delustred Rayons: Dyeing.** J. Lehembre. *Teintex*, 1942, 7, 192-194 (through *Chem. Zentr.*, 1942, ii, 2742-2743 and *Chem. Abstr.*, 1944, 38, 3132<sup>6</sup>). Substantive dyeing on delustred viscose and acetate rayons requires appreciably more dye than does dyeing on lustrous goods. The mat effect is suppressed greatly by dark, especially black dyeing. C.

**Rayolanda, Nylon, Casein and Alginate Textiles: Dyeing.** C. M. Whittaker. *Chemistry and Industry*, 1944, 269-271. A report of a lecture about the characteristics of the "new rayons" with special reference to their affinity for different classes of dye. C.

**Staple Fibre and Artificial Protein Fibre Fabrics: Dyeing.** G. Hammar. *Färgeritekn.*, 1942, 18, 173-178 (through *Chem. Zentr.*, 1943, i, 92 and *Chem. Abstr.*, 1944, 38, 3132<sup>3</sup>). A detailed discussion of the use of chromium-free dyes, the dyeing of strongly and slightly absorbing grades of staple fibre to the most nearly uniform colour tone possible, the dyeing of artificial protein fibres with preservation of the properties of the fibres, and possibilities of increasing wet resistance and lowering the sensitivity to higher temperatures. Numerous dyes which are suitable for the various purposes are mentioned. C.

**Cotton: Dyeing with Dye Mixtures.** J. Jensen. *Kem. Maanedstidende*, 1942, 23, 105-109 (through *Chem. Zentr.*, 1943, 1, 450 and *Chem. Abstr.*, 1944, 38, 3132<sup>7</sup>). The theory of dye adsorption by cellulose fabric and its application to dye mixtures (extension of Langmuir's equation) is discussed, and experiments are described on the dyeing of cotton with mixtures of a slowly dyeing dye with great affinity for cellulose (Chicago Blue B) and a rapidly dyeing dye of low affinity (Chrysophenin G). At all concentrations there was found a decrease in the amount of Chicago Blue adsorbed on the addition of Chrysophenin; however, the reverse was not the case. This is explained by the theory that after the entrance and adsorption of the quickly diffusing dye in the cellulose a displacement by the large molecules of the slowly diffusing dye becomes very difficult. C.

**Direct Dyeings: Improving Fastness to Washing.** I. T. Strukov and V. P. Smirnov. *J. Chem. Ind. (U.S.S.R.)*, 1941, 18, 12-16 (through *Chem. Zentr.*, 1943, 1, 331 and *Chem. Abstr.*, 1944, 38, 3133<sup>4</sup>). In order to improve the washing fastness of direct dyeings, condensation products of dicyanodiamide and formalin dissolved in acetic or formic acid are used. Solution in formic acid, however, causes some decomposition of the condensation product and lessens its ability to increase the fastness. The solution of the condensation product in the theoretical amount of acetic acid gave good results. The condensation product is not uniform; it consists of three substances which influence the various dyes to different extents. The solutions increased the washing fastness, but decreased the light fastness of the dyeings. The solution of the condensation products in acetic acid can be effected by introducing the acetic acid at the beginning of the condensation. Such a solution improves the washing fastness without influencing the light fastness. C.

**Sulphur Dyed Cotton: Adsorption of Other Types of Dyes.** V. V. Golosov and A. P. Smirenskiĭ. *Tekstil. Prom.*, 1943, 3, No. 10, 11-14 (through *Chem. Abstr.*, 1944, 38, 3133<sup>9</sup>). In wool fabrics containing cotton thread, the cotton is dyed with sulphur dyes, then the fabric is dyed by methods used for wool with acid or with chromium dyes. The double dyeing produces an uneven colour that is not fast to rubbing. This is attributed to adsorption of the acid dyes by the previously dyed cotton as well as by the wool. Bleached cotton fabrics were dyed first with sulphur dyes, then washed and dried, and treated with various acid, chromium and direct dyes. The results are tabulated and summarised. The adsorption of acid, chromium and direct dyes by cotton previously dyed with sulphur dyes is regarded as the formation of a lake on a colloidal substratum, since the sulphur dye, being amorphous, has a large adsorbing area. According to the electrochemical theory of dyeing, the hydrogen ions of the acid medium impart a positive charge to the sulphur dye on the cotton. This attracts the anions of the wool dye to the sulphur dye. The variations in the degree of adsorption of various dyes are explicable by the Goodall theory. Recommendations are made for reducing the adsorption of acid and chromium dyes by dyed cotton, for reducing the quantity of dye used and for avoiding defective dyeing. C.

**Microscopic Studies of Chemical and Physical Processes in Furs.** E. Lehmann. *Textilber.*, 1941, 22, 145-153 (through *Chem. Zentr.*, 1941, II, 410 and *Chem. Abs.*, 1944, 38, 1373). Furs present certain difficulties in cold dyeing operations, e.g. in a rabbit skin the wool-like hair is dyed well by an oxidation dye, while the straight hairs and guard hairs hardly absorb any dye. This problem was investigated by numerous microscopic studies of rabbit hairs. The structure of animal hairs requires that, for normal dyeing with oxidation dyes, (1) the epidermis membrane must retain its permeability, and the interaction between dichromate and hydrogen peroxide should not lead to spontaneous oxidations which fix the dye in the outer zone of the hair; (2) the size of the dye particles should be such that diffusion is possible; (3) the velocity of the dyeing process should correspond to the diffusion process. W.

#### (J)—PRINTING

**Indigosol Reserves: Development under Aniline Black.** W. Hess. *Textilberichte*, 1942, 23, 601-602 (through *Chem. Abstr.*, 1944, 38, 3131<sup>3</sup>). The disadvantages of the ammonium oxalate, the sodium citrate-aluminium chlorate, the dichromate and the sulphuric acid-nitrate processes are discussed. In oxidation by means of ferric salts, Prussian blue is deposited on the goods as a

result of reaction of the ferric salt with potassium ferrocyanide used as an oxygen carrier in the aniline-black bath. Laboratory tests showed that this can be removed by treatment with sodium carbonate and dissolving in acid the ferric hydroxide formed. However, this procedure is not very practicable on a commercial scale. Calgon can rapidly decompose Prussian blue to form sodium ferrocyanide and a soluble complex ferric metaphosphate. The following development process was worked out: The goods treated with aniline black were printed with white reserve and indigosol reserves, steamed 4-5 min. in a quick steamer, treated on a dyeing machine by means of a bath of 10 g. ferric chloride + 20 c.c. of 66° Bé. sulphuric acid per l. for 20 sec. at 90°, rinsed, treated in a hot bath of 3 g. sodium dichromate/l., and rinsed again, then soaped in a hot bath of 3 g. of Calgon + 3 g. of Gardinol/l. for 1-2 min. and washed. The sodium dichromate can be replaced with sodium percarbonate or potassium persulphate as this treatment is used merely to oxidise the aniline black completely. Large-scale tests showed also that Calgon can be replaced by Trilon A  $\{N(CH_2CO_2Na)_3\}$  or Trilon B  $\{C_6H_4[N(CH_2CO_2Na)_2]_2\}$ . The white and coloured reserves produced are very pure and bright. Some indigosol dyes, e.g. indigosol violet 1BBF, cannot be developed by this new process. Reserve printing with Rapidogen dyes and Indigosol dyes can be carried out readily. The development does not injure the colour tone of the Rapidogen print. C.

**Mordant Dyes: Fixation. Indigosols: Development.** E. Y. Podreshetnikov, N. E. Fedorova and A. N. Burlakova. *Tekstil. Prom.*, 1941, No. 5, 33-34 (through *Chem. Zentr.*, 1943, i, 331 and *Chem. Abstr.*, 1944, 38, 3131<sup>2</sup>). Steaming of ammonium chromate liberates chromium trioxide, which oxidises indigosols and is converted into chromium sesquioxide; ammonium chloride used simultaneously forms an acid medium. Based on these facts is a process for manufacture of a fast green dischargeable dye, which consists of indigosols and Chromcitronin. The process is described in detail. C.

**Vat Dye Prints: Steaming.** W. Hess. *Textilberichte*, 1942, 23, 346-348 (through *Chem. Abstr.*, 1944, 38, 3130<sup>3</sup>). The steaming operation is affected by physical and chemical factors. The conditions necessary for satisfactory steaming of textiles printed with vat dyes are discussed in detail. The use of sodium formaldehyde sulphonylate, caustic soda and potassium carbonate as textile assistants is described. C.

**Rayon Fabrics: Tendering in Printing.** *Ciba Review*, 1944, No. 47, 1715. In a particular style of printing, rayon fabric was dyed, printed with a discharge, and then, to avoid the formation of doctor streaks in ageing, padded on the printing machine with gum tragacanth and an assistant (Albatex BD). Tendering in the printed parts occasionally occurred and it was found that the fibre in these parts was completely flattened and more wettable. The explanation offered is that the yarns were sharply bent by the engraving of the printing roller, and were set in this bent condition by the drying of the printing paste. The pressure of the padding roller, combined with tension in the yarns due to irregular wetting, brought about rupture of the filaments. The trouble was cured by padding before printing. C.

**Steel Printing Cylinders: Copper-coating and Etching.** N. P. Batsyn. *Tekstil. Prom.*, 1943, 3, No. 10, 16-19 (through *Chem. Abstr.*, 1944, 38, 3134<sup>3</sup>). The preparation of copper-coated and engraved steel cylinders is described in detail. C.

**Viscose Rayon: Screen Printing with Acid Dyes.** R. Franzoso. *Textilberichte*, 1943, 24, 313-314 (through *Chem. Abstr.*, 1944, 38, 3134<sup>2</sup>). The operation is discussed in detail and suitable recipes are given. C.

#### (K)—FINISHING

**Natural and Artificial Fibre Mixture Fabrics: Resin Finishing.** T. S. McDuffey. *Textile Bull.*, 1944, 66, No. 2, 22, 24; No. 3, 10, 45-46 (through *Chem. Abstr.*, 1944, 38, 3138<sup>8</sup>). A discussion of the essential factors for obtaining well-prepared piece goods in the different blended constructions, and dyeing with direct cotton and acetate dyes and with vat dyes that are available for civilian use. Practical applications of melamine resins are discussed. C.

**Reducing Wool Shrinkage and Felting with Melamine Resins.** E. P. Johnstone. *Amer. Dyes. Rep.*, 1944, 33, 301-303. Methylol melamines, produced by the reaction of formaldehyde with melamines, are alkylated by alcohols,



e.g. methanol, to give resins which may be used to reduce the felting properties of wool (U.S.P. 2,329,622, these *Abs.*, 1944, A110). The wool is thoroughly impregnated at ordinary temperatures with a 2-15 per cent. solution of a water-soluble resin containing a suitable catalyst, the excess solution removed and the fabric dried. The resin, which is polymerised by heating at 230-300° F. for 4-45 min., is distributed uniformly throughout the fibres. The shrinkage-resistance of the fabric is not removed by repeated washing. W.

**U.S. Army Socks: Shrink-resistance.** Philadelphia Quartermaster Depôt, Research and Development Division. *Text. World*, 1944, 94, No. 5, 95. Part-wool socks are wet chlorinated in the grey, hypochlorites being used in conjunction with other retarding agents [unspecified] which produced a buffer effect. The life of the socks is increased 40 per cent. Specifications will be issued when problems have been solved involving choice of chemicals, prevention of over-treatment, and test methods. Similar treatment is being considered for 50 per cent. wool underwear. W.

#### (L)—PROOFING

**Aliphatic Chloromethyl Ethers: Preparation, Properties and Use in Finishing.** D. N. Kursanov and V. N. Setkina. *J. Appl. Chem.* (U.S.S.R.), 1943, 16, 36-46 (through *Chem. Abstr.*, 1944, 38, 3138<sup>9</sup>). In the course of the study of the interaction of compounds of the Velan type for water-repellent treatment of cellulose, the authors studied the preparation and properties of various chloromethyl ethers. The ethers were prepared by means of polyoxymethylene, hydrogen chloride gas and the corresponding alcohols. Properties of the butyl and higher ethers are indicated. The ethers are readily condensed with pyridine by mixing the reactants with cooling; the products, being poorly soluble in ether, are readily purified by washing with ether. They are soluble in water, the higher members forming opalescent solutions. The octadecyl ether was also condensed with trimethylamine in benzene solution, the product being insoluble in benzene and soluble in water. Dimethylaniline was used in a condensation with the tetradecyl ether; only 50 per cent yield of product was obtained even after 24 hours. Samples of cloth were treated with aqueous solutions of the ethers containing sodium acetate, dried, heated at 105° for 30 min., laundered and washed with benzene and water. Compounds of C<sub>11</sub> or higher alcohols imparted definite water repellency to cloth. Similar treatment in benzene-pyridine solution showed that compounds based on trimethylamine required a temperature of 140° for chemical binding to cellulose, the degree of water repellency being essentially unaffected by the nature of the nitrogenous base used. C.

**Canvas: Impregnation.** M. Chilikin. *Tekstil. Prom.*, 1943, 3, No. 11/12, 13-15 (through *Chem. Abstr.*, 1944, 38, 3141<sup>9</sup>). For impregnating canvas, paraffin may be replaced by ceresin and ozocerite, and soap can be replaced by naphthenates obtained as by-product from oil distilleries. The use of iron salts does away with the need for acetic acid, substituting for it basic aluminium sulphate. Wastes, e.g. from dichromate manufacture, contain up to 28 per cent. of aluminium oxide soluble in sulphuric acid. This should be salvaged and used in canvas plants. Alunite deposits in central Asia are another source of aluminium sulphate. Oak extracts can be successfully replaced by extracts of willow, pomegranate, Mongolian tea, etc. These are used for fixing copper and chromium salts. C.

**Furs: Mothproofing.** D. Traill, A. McLean and H. H. S. Bovingdon. *Chem. & Ind.*, 1944, 284-286. A description of the experimental work which led to the development of mothproofing furs with a saturated solution of sodium chloride containing small concentrations of formaldehyde and hydrochloric acid. The process is covered by B.P. 548,061 (these *Abs.*, 1943, A26). Using this treatment, the results are given of mothproofing tests on furs under different conditions of pH, time and temperature, and on furs dyed after proofing. For furs, the treatment should be comparatively inexpensive, and would replace the usual acid/salt pickle. In oviposition tests on wool, the number of eggs laid on the untreated material was over 10 times as great as the number laid on treated material, but the economic use of the treatment would appear to be doubtful. W.



## PATENTS

**Water-sensitive Rayon Fabrics: Production.** J. G. Williams and L. Krause. B.P.563,133 of 7/12/1942:1/8/1944. Textile materials having a very low wet strength but a substantial dry strength are produced by subjecting an organic ester of cellulose, particularly the acetate, in the form of filaments or yarns, but preferably as fabric, to the hydrolytic action of dilute sulphuric or hydrochloric acid, until the wet strength of the material has been reduced to the desired value. C.

**Stable Hypochlorite Solutions: Preparation.** W. R. Bruce. B.P.563,136 of 21/2/1943:1/8/1944. Stable sodium hypochlorite solutions are prepared by adding calcium hypochlorite to a hot aqueous solution containing considerable excess of alkali carbonate over that required to convert all the calcium to calcium carbonate and separating the latter from the dissolved alkali hypochlorite. The addition of sodium chloride either simultaneously with or subsequently to the addition of the calcium hypochlorite is advisable. The alkali carbonate may be employed partly or wholly as bicarbonate and the solution may also contain borax and/or magnesium carbonate. C.

**Cellulosic Textile Materials: Finishing.** American Cyanamid Co. B.P. 563,172 of 15/8/1942:2/8/1944 (Conv. 30/8/1941). A method of finishing cellulosic textile materials, comprises applying an aqueous solution of a methylated methylol-melamine, and then curing the agent to a substantially water-insoluble condition. Fabrics may be filled and weighted and given a soft, springy handle and a fair degree of water repellency by such treatments. Substantial resistance to shrinking is imparted by the application of 2-8 per cent. by weight of the agent. With 8-14 per cent. the fabrics acquire increased resistance to shrinkage and also crease-resisting properties. The treated materials show unexpectedly low chlorine retention when subjected to laundering operations involving bleaching steps. C.

**Cellulose Acetate Materials: Dyeing.** British Celanese Ltd. B.P.563,181 of 5/11/1942:2/8/1944 (Conv. 12/11/1941). Cellulose acetate is subjected to the action of 23-40 per cent. caustic alkali at such a temperature and for such a time that the percentage of acetyl (calculated as acetic acid) is not reduced by more than 7, washed, and dyed with a direct dye. The caustic alkali treatment increases the affinity of the material for the dye and the resistance to acid fading of the resulting colouration is notably better than that produced without the alkali treatment. In general good results are obtained by alkali treatments at 20°-30° C. for periods of 30-120 sec. The method described is particularly advantageous for the dyeing of fabrics woven from yarns which are normally dyed to deep shades only with difficulty, i.e. yarns of high denier having a high filament count. C.

**Light-resistant Cellulose Derivative Compositions.** H. Dreyfus. B.P. 563,287 of 6/11/1942:8/8/1944. The undesirable action of ultra-violet light on fibres, foils, and similar products having a basis of cellulose acetate or other cellulose ester or ether can be greatly reduced by including in the composition up to 15 per cent. of an ester of low volatility of a hydroxybenzene or hydroxynaphthalene monocarboxylic acid, with a phenol, an alcohol containing an aromatic nucleus, or a cyclo-aliphatic alcohol. This ester may be added to spinning solutions or the formed products may be impregnated with solutions of the ester. A film (0.002 in. thick) of cellulose acetate containing about 5 per cent. of  $\beta$ -naphthyl salicylate on the weight of the cellulose acetate suffers, on exposure to light from a mercury vapour lamp, a percentage loss in strength of only about one-eighth of that of a similar film free from the salicylate. The esters are substantially retained in the material and remain effective during normal storage and use of the cellulose ester or ether products. C.

**Waterproof Fabric: Production.** Lustrafil Ltd. and G. L. Godman. B.P. 563,586 of 9/10/1942:22/8/1944. A process for the manufacture of waterproof fabric by impregnating and/or coating a cellulosic fabric with a resin and then with a non-tacky varnish is characterised by the feature that the first resin is an adhesive oil-modified alkyd resin substantially free from protein or any other synthetic resin, so as to produce a pliable fabric capable of high resistance to repeated stretching and bending. The outer or final coating is an oil, lacquer or varnish such as is normally employed in the production

of oiled fabrics or is capable of being so applied. When more than two coatings are applied the intermediate coating or coatings may consist of a mixture of a varnish with the synthetic resin forming the first coating or plasticizing agents or both. Fabrics may be coated on one or both sides. The fabrics may be dyed or printed or treated with softening agents or rendered crease-resistant prior to coating and pigments or soluble dyes may be incorporated in the film-forming solutions or dispersions applied. The waterproof fabrics produced by this method may be used for the production of waterproof garments, transparent curtains and decorative materials. C.

**Polyvinyl Adhesive Compositions.** British Thomson-Houston Co. Ltd. B.P. 563,624 of 7/10/1942:23/8/1944 (Conv. 10/10/1941). An adhesive composition comprises a solvent and a resinous component which consists of 10-50 per cent. of a polyvinyl ester, e.g. polyvinyl acetate, and 50-90 per cent. of a resinous mixture consisting of the reaction product of endomethylene tetrahydrophthalic anhydride and polyhydric alcohols averaging 2-3 hydroxyl groups per molecule and the reaction product of maleic anhydride and polyhydric alcohols averaging 3-4 hydroxyl groups per molecule, the endomethylene tetrahydrophthalic anhydride reaction product being present in a major amount and the maleic anhydride-polyhydric alcohols being present to the extent of at least 5 per cent. Compositions of this type may be used for bonding steel laminations and the individual turns of electric coils, in the manufacture of laminated glass fibre and asbestos articles, and for the bonding of mica to a backing of glass fibre cloth. C.

**Dyeing Tank or Vat.** Mellor Bromley & Co. Ltd., S. R. T. Freeman and G. S. Helliwell. B.P. 563,634 of 23/11/1942:23/8/1944. A tank or vat for treating materials with dyeing and other liquids is constructed with a bottom of uniformly rounded form and with a perforated tube or tunnel in the rounded formation at or near the bottom which provides for the circulation of the liquid and accommodates a propeller or propellers whereby the liquid is circulated. Preferably, the upper part is flared and the tank or vat is suspended from supporting members, e.g. parallel beams or bars, without enclosure in a casing. The described construction and mounting minimise buckling, facilitate cleaning, and reduce matting of hanks. C.

**Fabric Shrinking Apparatus.** J. J. Hadfield and D. Bamford. B.P. 563,638 of 18/2/1943:23/8/1944. Apparatus for shrinking fabrics comprises an endless and elastic rubber band adapted to be supported upon and driven by revolvable rollers, wherein one of the rollers is driven through variable speed mechanism at a variable higher speed than the preceding roller so that a portion or section of the endless band is in a state of tension or stretch proportional to the relative speeds of the rollers when it receives the wetted or conditioned fabric, which tension or stretch is relaxed with a resulting contraction in length equal to the amount of stretch over each successive length of the endless band where it makes contact with the intervening fabric against a revolving burnished drying cylinder the location of which causes successive lengths of the resiling endless elastic band and fabric to follow the contour of the highly burnished cylinder while shrinkage of the fabric takes place, the extent of the shrinkage of the fabric being proportional to the contraction of each successive length of the endless band. C.

**Resin Dispersions: Preparation and Application.** E. I. Du Pont de Nemours & Co. B.P. 563,707/8/9/10/11/12/13 of 5/8/1941:28/8/1944 (Conv. 3/8/1940). (1) Stable dispersions of polymerised methacrylic acid esters which are useful for the treatment of textiles and are compatible with many finishing agents are produced by agitating a monomeric methacrylic acid ester containing a small proportion of a polymerisation catalyst, e.g. benzoyl peroxide, with so much of an aqueous solution of a partially saponified polyvinyl acetate having a saponification number between 40 and 130 and in a 4 per cent. (by weight) aqueous solution a viscosity between 10 and 30 centipoises at 20° C., as will give between 0.75 per cent. and 5 per cent. by weight of partially saponified polyvinyl acetate in the dispersion until a dispersion of the monomer is obtained and then heating to produce polymerisation of the methacrylic acid ester. (2) Stable dispersions which are substantive to animal and nylon fibres are prepared as described above, but with the addition of a water-soluble salt of a heavy metal or a multivalent metal. (3) Dispersions which are substantive

to nylon, animal and cellulose fibres are prepared as in (1) but with the addition of a cationic surface tension reducing agent and, if desired, a water-soluble salt of a heavy metal or a multivalent metal. (4) Stable resin dispersions suitable for the treatment of textile materials are produced by dissolving a natural or synthetic resin in a methacrylic acid ester, adding the solution to an aqueous solution of a partially saponified polyvinyl acetate of the characteristics and in the proportion specified in (1), agitating the mixture until a dispersion is obtained and thereafter heating to cause the methacrylic acid ester to polymerise. (5) Stable resin dispersions which are substantive to animal and nylon fibres are prepared by dissolving a resin in a methacrylic acid ester, adding a solution of partially saponified polyvinyl acetate as above, and agitating the mixture in the presence of a water-soluble salt of a heavy metal or a multi-valent metal. (6) For the production of dispersions which are substantive to nylon, animal and vegetable fibres, the mixture of (4) is agitated in the presence of a cationic surface tension reducing agent and, if desired, of a water-soluble salt of a heavy metal or multivalent metal. (7) A resin dispersion which is substantive to nylon, animal and cellulose fibres comprises an aqueous dispersion of a polymer of a methacrylic acid ester which has been polymerised in the presence of an aqueous solution of a cationic surface tension reducing agent and, if desired, of a water-soluble salt of a heavy or multivalent metal. A natural or synthetic resin may be dissolved in the methacrylic ester. Examples are given of the application of these resin solutions in the finishing of textile materials. C.

**Mordant Monoazo Dye: Production.** Brotherton & Co. Ltd. and P. C. Holmes. B.P.563,772 of 22/2/1943:29/8/1944. A mordant monoazo dye is produced by coupling *m*-xylenol with diazotised picramic acid. It gives an olive green tone when dyed on wool by the after-chrome or single bath chroming processes. C.

**Fabrics: Joining by Fusion.** British Celanese Ltd. (Celanese Corporation of America). B.P.563,860 of 13/1/1943:1/9/1944. A method of joining edge to edge pieces of textile fabric, at least one of which consists of or contains thermoplastic material, comprises bringing together surfaces of marginal portions of the fabric adjacent to the edges and at a series of spaced positions within the area of contact, heating the fabrics so as to render the thermoplastic material adhesive and attach one of the pieces of fabric to the other at the said positions. With non-thermoplastic fabrics, the marginal portions of the fabrics are brought together with an interposed strip of thermoplastic foil, film or textile fabric, and the assembly is heated at spaced positions. A device suitable for carrying out the joining operation comprises a handle, a roller mounted on the handle, a number of elements capable of being heated and carried by the roller, at least a part of these elements projecting from the periphery of the roller, and means for applying heat to the elements. The elements carried by the roller may consist of projections such as ribs, teeth or bars which can be heated and which, when brought into contact in the heated condition with the pieces of fabric to be joined together, will effect localised heating in a pattern defined in accordance with the disposition of the projections. C.

**Tentering Machine Vacuum Extractor.** Celanese Corporation of America. U.S.P.2,338,167. The cloth passes over a slotted vacuum tube for sucking off liquid. A tape, responsive to the movement of the tenter table, is attached to one end of the tube to close a portion of the slot. C.

**Laminated Elastic Fabric: Production.** United States Rubber Co. U.S.P. 2,338,243. Elastic rubber sheet is bonded to a fabric that is more condensed and extensible in some areas than in others. C.

**Pigment Fabric Decorating Composition.** Interchemical Corporation. U.S.P. 2,338,252. A pigment is dispersed in a mixture of polyvinyl alcohol solution and urea-formaldehyde resin to which is added a nitrogenous base that will evaporate from a thin film of the composition in a few minutes at 150° C. The base prevents the mixture from gelation in storage. C.

**Tubular Knitted Fabric: Finishing to Simulate Woven Fabric.** L. te Strake (Netherlands; vested in the U.S. Alien Property Custodian). U.S.P.2,338,386. Tubular knitted fabric is fulled in a soap solution at 25° C. for 1-2 hours, then

joined end to end and passed continuously through the soap for another 1-2 hours, so that it shrinks 40-50 per cent. in length and 25 per cent. in width, and finally dried under tension so that the circumference increases again by about 10 per cent. C.

**Fabric Containing Thermoplastic Fibre: Shrink Finishing.** American Viscose Corporation. U.S.P.2,338,391. Fabric containing thermoplastic fibre is advanced under stretch and treated with a swelling agent so as to increase the crimp in the weft, then heated to make the thermoplastic fibre tacky, allowed to shrink under compression, and finally cooled and set. C.

**Beaded Upholstery Fabric: Production.** National Automotive Fibres, Inc. U.S.P.2,338,490. A flat piece of uncured, blowing rubber stock is laid on a panel board, covered with a fabric, and then put under a deeply recessed die to which suction can be applied to draw the fabric and rubber into a raised bead. Heat is then applied to vulcanize the rubber and cause it to blow and fill the bead. C.

**Cellulose Esters: Rendering Susceptible to Basic Compounds.** Eastman Kodak Co. U.S.P.2,338,587. Partially hydrolysed lower fatty acid esters of cellulose are rendered susceptible to basic compounds by treatment with 1-2 molecular proportions of nitrogen dioxide and 1-10 per cent. of moisture. C.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Cambodia Cotton Fibres: Measurable Characters; Variations with Place of Growth.** R. L. N. Iyengar. *Indian J. Agric. Sci.*, 1943, 13, 434-445. A report is given of observations of the variations in the measurable characters of the same set of cottons grown at two different places (Coimbatore and Srivilliputhur) for five seasons. The material was collected from pure strains of Cambodia cotton (*G. hirsutum*). Seed weight, lint weight, ginning percentage, mean fibre length, mean fibre weight per cm., unit fibre weight, standard fibre weight, number of fibres per seed and maturity percentage were determined, and the mode of development of the fibres was studied. The results show that at Srivilliputhur the fibres are longer, finer, more mature, but fewer in number on the seed than at Coimbatore. The maturation period of the boll and the lengthening and thickening phases of the fibre are less and hence the rate of length development and the rate of secondary wall deposit are higher at Srivilliputhur. The improved length and fineness of the fibres and the reduction in their numbers per seed at Srivilliputhur appear to be caused by the higher temperature and solar radiation at this place. C.

**Cotton Fibre Primary Wall: Structure.** K. Hess, W. Wergin and H. Kiessig. *Planta*, 1942, 33, 151-160 (through *Chem. Zentr.*, 1942, ii, 2220). Based upon information gained from the study of young seed hairs the authors propose a model for the structure of the primary wall of which the characteristic feature is the concept of ribs of cellulose-pectin. These ribs are diagonal to the axis of the hair and are encased in a sheath of fat and wax. The attachment of the sheath to the rib is supposed to involve lecithin. The primary wall can consist of no more than a single lamella. C.

**Damaged Fibre: Testing.** H. Rath and W. Meyer. *Textilberichte*, 1943, 24, 353-355 (through *Chem. Abstr.*, 1944, 38, 2826<sup>a</sup>). The mechanical testing of fibre deterioration brought about by chemical or thermal action is useful only when this deterioration is rather extensive as measured by changes in the degree of polymerisation. On the other hand, in some cases mechanical tests indicate changes in the fibre that cannot be measured fully by determination of the degree of polymerisation. For changes that cause embrittlement, and hence a decrease in the elasticity of the fibre, measurement of elasticity is a better criterion than is measurement of strength. Extensive bleaching damages can be detected not only by the decrease in the degree of polymerisation but also by the decrease in tensile strength on boiling the bleached goods with sodium carbonate. Measurement of the degree of polymerisation is not applicable to the determination of fibre deterioration of staple fibre that has been pretreated with strong caustic soda solution; mechanical tests are necessary. C.

**Fibres: X-ray Analysis.** Institute of Physics. *J. Sci. Instruments*, 1944, 21, 115-117. An illustrated report of a conference, with summaries of contributions by (1) W. T. Astbury, calling attention to the failure of X-ray photography to distinguish between normal, acid-tendered and oxidised cotton; (2) E. Aruja, on peculiarities in the structure of chrysotile (asbestos); and (3) C. W. Bunn, on the structure of simple high-polymers, like polyisobutylene filaments, which show very many sharp spots in the stretched condition. C.

**Textile Fibres: Molecular Orientation and Physical Properties.** J. W. Illingworth. *Textile Recorder*, 1943, 61, September, 44-48; 1944, 61, February, 56-61. A broad review of recent work on the influence of molecular orientation on (a) strength, (b) extensibility, (c) swelling, (d) crease resistance, (e) dye affinity, (f) lustre. C.

**Cotton, Silk and Wool: Density and Sorptive Capacity.** P. M. Heertjes. *Rec. trav. chim.*, 1942, 61, 751-762 (through *Chem. Zentr.*, 1943, i, 228-229 and *Chem. Abstr.*, 1944, 38, 3137<sup>n</sup>). The density of a hydrophilic fibre in water is considered theoretically. The true volume of water held by 1 c.c. of dry fibre is  $1 + (q^1/100) = d_h[(p/s) + (1/d_w) + (1/d_h) - (1/d_b)]$ , where  $q^1$  = volume increase by water taken up minus the volume of the non-accessible pores of the fibre as determined by sorption with benzene  $d_h$ ,  $d_w$ ,  $d_b$  = the densities of the fibre in helium, water and benzene,  $s$  = density of water and  $p$  = g. of water adsorbed per g. of fibre substance. At first the water molecules enter the outer layers of the fibre. Then the water intake continues by adsorption on the inner and outer fibre substance without any noticeable change in volume. Finally the water is taken up by capillary condensation in the pores of the fibre, still without any noticeable change in volume. The absorbed water affects the determination of the density of the fibre in water, but not the adsorbed water and water taken up by capillary condensation. For cotton and silk, dyed and undyed fibres take up the same quantities of water. The affinity of wool for water is increased appreciably by dyeing and felting. C.

**Cotton, Wool, and Dyes: Effect of High Temperatures.** H. J. Henk. *Spinner u. Weber*, 1942, 60, No. 11, 22-23 (through *Chem. Zentr.*, 1943, ii, 1685 and *Chem. Abstr.*, 1944, 38, 3132<sup>n</sup>). Cotton withstands temperatures up to 300° for short periods, but chars completely at 120° after several months. At 80° there is a decrease in elasticity and dye absorption; at 180° the elasticity has dropped 50 per cent. and the dye absorption becomes nearly zero. Water absorption and fluorescence change similarly with heating. Wool is damaged by brief heating to 150° and by prolonged heating to 50°. Substantive dyes are decomposed completely at 270°; Naphthol AS dyes, only above 300°. Superheating on driers should be avoided, particularly with fabrics that have been impregnated with chlorides or sulphates. C.

**Degummed Silk: Moistening.** S. Avirom. *Legkaya Prom.*, 1940, 19, No. 11-12, 39-44 (through *Chem. Zentr.*, 1941, ii, 3014-3015 and *Chem. Abstr.*, 1944, 38, 3138<sup>n</sup>). Results of laboratory tests showed that (1) the higher the relative humidity in the moistening chambers the faster the moisture absorption by silk and (2) the humidity in these chambers should be held at 92-98 per cent. in order to prevent condensation of water on the fibre. The correctness of the laboratory tests was checked by plant tests at 92 per cent. relative humidity at 18-20°. On an industrial scale the new method showed many advantages, increased the yield of carded fibres and improved the quality of the goods. C.

**Fibres: Determination in Mixtures.** G. Romeo. *Laniera*, 1942, 56, 179-199 (through *Chem. Zentr.*, 1943, i, 583 and *Chem. Abstr.*, 1944, 38, 3136<sup>n</sup>). The table includes wool, silk, cotton, hemp, jute, lanital, rayon and acetate rayon. The fibres are identified by macroscopic and microscopic examination and by the use of the following reagents: acetone, 58° Bé. sulphuric acid, basic zinc chloride solution ( $d. 1.835$ ), 10 per cent. caustic soda, Löwe's copper solution containing glycerol, 20 per cent. sodium sulphide solution, 8 per cent. sodium sulphide solution and ammoniacal copper oxide solution. Formulæ are given for calculating the proportions and numerous tables are shown. C.

**Fibres: Fine Structure and Properties.** K. Hess. *Textilberichte*, 1943, 24, 287-293 (through *Chem. Abstr.*, 1944, 38, 3135<sup>n</sup>). A discussion of molecular

size, structure and fibre properties, strength of synthetic fibres and comparison with natural fibres, the natural formation of the cotton hair and optical-microscopic and electron-microscopic examination of natural cellulose fibres. C.

**Iodine Fibre Stains: Activity.** H. W. Rowe. *Paper Trade J.*, 1943, 116, TAPPI, 102-110. Literature on the mechanism of fibre staining by agents containing iodine is reviewed from the time of Gmelin (1830). Typical iodine stains for paper-making materials are described and their staining effects on acetylated cotton celluloses (Ac. 8.7, 57 and 61 per cent.) are tabulated. Accounts are also given of the staining of various celluloses from spruce and oxycellulose, of the effects of pre-treatment of fibres with salts before staining, and of the effects of adding salts to the staining reagent. The effects are interpreted in terms of colloids. C.

**Photo-electric Photometer: Construction and Applications.** N. H. Chamberlain. *J. Textile Inst.*, 1944, 35, T61-76. C.

**Pulp Fibres: Ultimate Strength.** J. d'A. Clark. *Paper Trade J.*, 1944, 118, TAPPI, 1-6. The author reviews attempts to utilise the breaking load of a pulp test sheet between close jaws ("zero span") as a measure of the ultimate fibre strength and therefore of the tendering effects of bleaching and similar agents. An improved type of jaw is described that ensures fit of the edges to within 0.0001 inch. Experimental data are recorded in demonstration of the following effects: (1) Clamping pressure, with sheet cellulose and a soft, bulky paper; (2) Extent of beating of the pulp; (3) Fibre length, long fibres being collected separately on a 20-mesh screen; (4) Addition of locust bean mucilage to the pulp. It is shown that the "zero span" breaking loads are influenced to an extremely small extent by the compactness of the test sheet and by the bonding that results from beating or adding mucilage, but they are rather more dependent on fibre length. The test is not, therefore, a fundamental measure of ultimate fibre strength, but appears to offer a fairly good indirect measurement of that property. It is preferred to the more laborious determination of bursting strength on pulp sheets. C.

**Sea Island Cotton: Mildewing.** D. E. Klemme. *J. Bacteriology*, 1942, 43, 171-180 (through *Exp. Sta. Rec.*, 1943, 88, 424). Sea Island cotton fibre and yarn were sterilised and inoculated with a strain of *Chaetomium globosum*, isolated from mildewed canvas, and incubated for 28 days in a Warburg apparatus of the seven-manometer, refrigerated type. The growth of the organism was followed by daily measurements of oxygen consumption and by determination of catalase production as measured by the amount of hydrogen peroxide decomposed. In general the rate of growth of the organism on the fibre and on the yarn increased during the first 11 days, as indicated by the increased daily rate of oxygen consumption, after which it decreased. The amount of oxygen absorbed by the fungus growing on the fibre was significantly greater than that absorbed by the fungus growing on the yarn. Likewise, the amount of catalase produced by the fungus on the fibre was greater than on the yarn. These results indicated that, in general, raw cotton would deteriorate more readily in a moist atmosphere than would yarn or fabric, and more care, therefore, should be taken in storing the fibre. The accumulated amount of oxygen absorbed by the organism was estimated by adding the amount absorbed each day to the amount absorbed on previous days. The total amount absorbed by the fungus growing on 1 g. of the fibre for 28 days was 0.32 milliequivalent and on 1 g. of yarn 0.21 milliequivalent. By the method of least squares a fourth degree polynomial equation was found for the accumulated absorption values for the fibre and another for the yarn. C.

**Wool: Combination with Acids.** G. A. Gilbert and E. K. Rideal. *Proc. Roy. Soc.*, 1944, A 182, 335-346. An approximate titration equation is developed for the reaction between fibrous proteins and acids (wool; hydrochloric and sulphuric acids) in which account is taken of the valency and intrinsic affinities of the acid anions, and of the limited number of adsorption sites available for anions. The transition from soluble to fibrous proteins is traced in order to demonstrate that the main difference between their titration

curves arises from the difference in potential developed during the adsorption of protons. C.

**Keratin Fibres: Elasticity.** H. B. Bull and M. Gutmann. *J. Amer. Chem. Soc.*, 1944, 66, 1253-1259. The stress-strain relations of human hair have been investigated. It is concluded that irreparable damage to the hair occurs at extensions greater than 18 per cent.; below this extension the process is reproducible but essentially irreversible. It is suggested that Astbury and Bell's newer structure of  $\alpha$ -keratin (these *Abs.*, 1941, A385) is still too condensed, and that a process resembling a thixotropic gel-sol transformation occurs when hair is extended 3-20 per cent. W.

**Wool Fineness: Measurement.** H. J. Wollner, L. Tanner and H. H. Spiegel. *Amer. Dyes. Rep.*, 1944, 33, 307-308, 321-322. Von Bergen's wedge method for measuring fibre width (these *Abs.*, 1933, A60) has been modified, and the speed and precision of the measurements greatly increased. The modifications cover (1) the preparation of the slide for the projection of longitudinal fibre images, and (2) an improved measuring device. (1) The fibres are cut to very short lengths, about 75 microns, from sections prepared by the technique of Hardy and others (these *Abs.*, 1935, A316 and 1936, A335). A well-prepared slide shows a compact single layer of short fibres from which many measurements can be made after a single adjustment of the focus and stage. (2) A measuring device which retains the advantages of the wedge ruler and overcomes its disadvantages is illustrated. It consists of a calibrated spiral of Archimedes on a transparent rotary circular plate mounted on a baseboard. The latter serves as a screen for the image and is provided with four radial index lines with base lines normal thereto. Radii divide the curve into serially numbered sectors of uniform angular opening. Since the distance along an index line between a base line and the curve depends on the angular displacement, each section is a "cell" covering a fixed range of lengths. The fibre image is projected through the transparent scale on to the base. The device is moved so that a base line is tangent to one side of the superposed image at the desired point as defined by the index line. The scale is then rotated until the curve meets the intersection of the opposite side of the image with the index line, and a mark made with a soft crayon on the transparent scale in the cell over the index line. The process is repeated on other images until the required number of fibres has been measured. The number of marks in each cell is counted and the necessary calculations made. These are shown in tabular form and are based on the official method of the U.S. Dept. of Agric. (Amendment No. 2 to Service and Regulatory Announcement 135) and the Amer. Soc. for Testing Materials (these *Abs.*, 1942, A142). W.

## (B)—YARNS

**Nylon Yarn: Properties.** E. I. Du Pont de Nemours & Co. *Textile Manufacturer*, 1944, 70, 355-357; *Rayon Textile Monthly*, 1944, 25, 169-171. An authoritative statement, with data, concerning the breaking load and elongation, resistance to chemicals, resistance to abrasion, density, elastic recovery, delayed recovery, modulus of elasticity, inflammability, specific heat, heat of fusion, resistance to heat, resistance to insects and micro-organisms, resistance to light, moisture regain, shrinkage and swelling, and content of material lost in scouring, of recent nylon yarns. C.

**Yarn Twist Factor Formula: Extension to New Materials.** S. L. Gerhard. *J. Applied Physics*, 1944, 15, 474-476. Various yarn properties are defined and discussed and a brief explanation is given of the derivation of the conventional twist formula  $T = M\sqrt{C}$ , where  $T$  is the twist in turns per inch,  $C$  the yarn count and  $M$  the twist factor. Extensions are developed by means of which it is possible to copy a yarn made of familiar material in a new material and obtain the same helix angle, and to determine approximately the twist that should be inserted in spinning a new yarn and thus shorten the trial and error procedure necessary for finding the optimum twist. The calculation involves the filament density and the following values, in lb. per cubic foot, are tabulated: Paper 44-72, silk 78-81, wool 82-83, acetate rayon 83, cotton and linen 94-95, viscose rayon 95, cuprammonium rayon 95-96, nitro rayon 95-97, rubber 56-69, asbestos 156-165, glass 150-175. A simple formula is also derived for converting twist factors from one yarn count system to another. C.



## (C)—FABRICS

**Hosiery Shrinkage Measuring Device.** Textile Section, U.S. National Bureau of Standards. *Textile Research*, 1944, 14, 150-151. A device for measuring the dimensions of the feet of socks and other hosiery under different loads and the shrinkage produced by laundering consists essentially of a flat metal form made in two parts and having the shape of a boarded sock. One part includes the region of the toe and has a flat extension the full width of the foot which slips between the faces of the second part of the form. Thus it is possible to draw out the foot of the form to fill socks of different sizes, the width of the foot of flattened socks being the same for different sizes. The second part of the form, which includes the rest of the foot, heel and ankle, is provided with means for attaching it to the pulling member of a tensile testing machine and with a clamp for holding a sock on the form. In carrying out a test the sock is placed on the form and clamped at a fixed position across the ankle. Another clamp is attached to the toe by means of a pin which passes through the sock and through a hole in the form near the toe. This clamp is attached to the weighing mechanism of the testing machine. The length of the sock at different loads without reduction in width is obtained from the stress-strain record of the machine. By testing socks before and after laundering, changes in dimensions at stated loads may be evaluated. Similarly, socks may be loaded and unloaded repeatedly, and the accompanying changes in dimensions at stated loads may be measured. The device may be used without the tensile testing machine by attaching one end to a rigid support and adding weights to the other while it is hanging freely, and measuring the length of the sock on it. C.

**Cotton Goods: Testing.** F. H. Thies. *Kleppig's Textil-Z.*, 1942, 45, 434-439 (through *Chem. Zentr.*, 1942, ii, 2961 and *Chem. Abstr.*, 1944, 38, 3138<sup>6</sup>). Methods suitable for the industrial laboratory for determination of strength, determination of carbon and nitrogen, testing for oxycellulose, and investigation of the course of industrial processes are discussed. C.

**Substantive Dyed Cotton Fabric: Effect of Light and Weather on Strength.** F. I. Sadv and N. Kreindlina. *Tekstil. Prom.*, 1943, 3, No. 7/8, 11-14 (through *Chem. Abstr.*, 1944, 38, 3133<sup>6</sup>). Cotton fabric dyed with substantive dyes by various procedures, and fabric bleached but undyed, were exposed to weather facing south at a 45° angle for 3 months. Both dyed and undyed samples decreased in strength; this weakening was no greater in the dyed samples, and was even less than in the undyed if the dyed contained sufficient amino and hydroxy groups. Making the dye fast to washing by diazotisation followed by coupling with naphthols lowers the strength and light fastness of the fabric appreciably. Making the dye fast to washing by treating it with a dicyanodiamide condensate and fast to light by treating it with a copper salt increases the light resistance of the cotton considerably. The light fastness of some of these dyes compares favourably with the light fastness of indanthrenes; the indanthrenes contribute to the disintegration of the cotton fabric. C.

**Fabrics and Yarns: Resistance to Insect Pests.** J. R. Bonnar. *Amer. Dyes. Rep.*, 1944, 33, P266-269. Nine different fabrics, patterns of each being moth-proofed by different types of treatments, were tested in 12 different laboratories for resistance to moth attack, using both the excrement weight method and the fabric loss method. Comparison of the results showed that agreement was found from laboratory to laboratory only on the report of visual damage. The other results, although not varying greatly within each laboratory, varied too much between laboratories. It is recommended that visual damage should be used as the criterion, with the use of either the excrement weight method or the fabric loss method as a check. W.

**Mildew.** British Launderers' Research Association. *J. of Institution of British Launderers*, 1944, 25, 144. A short article dealing with the conditions under which mildew staining on fabrics may arise in the laundry and the effective treatment of such staining. La.

**Semi-stiff Collars.** British Launderers' Research Association. *J. of Institution of British Launderers*, 1944, 25, 177. A description of the types of semi-stiff



collars and a discussion of the faults which may appear in laminated collars during the laundering process. La.

**Bacterial Damage.** British Launderers' Research Association. *J. of Institution of British Launderers*, 1944, 25, 207-8. Bacterial damage may occur to wool and, to a lesser degree, cotton if goods are left in a damp condition. In one instance quoted, bacterial damage was associated with mildew damage. La.

#### (D)—OTHER MATERIALS

**Asphalted Paper: Testing Water Resistance.** E. G. Mullen. *Paper Trade J.*, 1944, 119, *TAPPI*, 11-12. The "dry indicator" test for determining the rate of transudation of water through paper is accelerated five-fold by raising the temperature of the water from 73° F. to 100° F. In the test, the indicator is spread on the specimen and covered by a sealed watch glass and the assembly is then left on water until there is an easily perceptible colour change over the entire area under the glass. Results are tabulated for 8 types of paper, including asphalted materials. C.

**"Flame-proofed" Paper: Inflammability Test.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1944, 119, *TAPPI*, 39. Particulars are given of a revised test (*TAPPI* "Suggested Method," T461 sm-43) for assessing the inflammability of treated papers and paper boards from measurements of the "char length" and duration of "after-glow." C.

**Paper: Curling Tendency Test.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1944, 119, *TAPPI*, 39-40. Particulars are given of a Tentative Standard test, *TAPPI* T466 m-44, for evaluating the tendency of sized papers to curl, in which a trapezoidal specimen is clamped at a definite angle across a hole in a float which is placed on water so that the under surface of the paper gets wet and its free end curls upwards. The angle through which the free end moves is read off on a degree scale and the time to reach the maximum is also observed. The length of paper that makes contact with the water is adjusted, by varying the size of the hole, so that the angle of curl comes between 30 and 60°. "Degree of curl" is the angle per centimetre of wetted paper. C.

**Paper: Water Vapour Permeability Test.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1944, 119, *TAPPI*, 35-38. Full details are given of Tentative Standard test, *TAPPI* 464 m-44, for determining the rate of penetration of water vapour through sheet materials by the method in which a desiccating agent enclosed in dish by the specimen under test is exposed to an atmosphere at  $100 \pm 1^\circ$  F. and  $90 \pm 2$  per cent. R.H. and the gain in weight is plotted against time and the slope of the curve is translated into grams per square metre of surface per 24 hours. The humidity gradient (90—less than 5) is more controllable than that previously used. C.

**Inflated Rubber Sheet: Bursting Strains.** L. R. G. Treloar. *Trans. Inst. Rubber Ind.*, 1944, 19, 201-211. The two principal strains in a circular sheet of rubber clamped round its circumference and inflated have been measured at various points on the surface of the spheroidal balloon thus formed. The variations of the strains with position and with degree of inflation are discussed and it is found that the principal strains may show relatively large variations over an area in which the form is nearly spherical and the thickness is approximately constant. Observations of the bursting of sheets of various rubbers (natural and synthetic) are reported and photographs of burst samples are given. The general type of burst was one in which the inflated sheet developed a number of radial tears starting at the centre and terminating on a well-defined circle, the appearance resembling that of the petals of a flower. There appeared to be a general relation between the hardness at the instant of breaking and the number and regularity of the radial tears. From the strain measurements the conclusion is drawn that the radial tears are not caused by the relatively slight radial orientation of the molecules in the sheet. A detailed mechanism of bursting is suggested, in which the radial tears are compared with the radial cracks associated with glass fracture. C.

**Resins: Application in Paper Processing.** J. Y. Kao, L. Gold, A. Stull, R. Worden and W. Abramowitz. *Paper Trade J.*, 1944, 119, *TAPPI*, 22-27. A broad summary is given of the uses of resins in paper processing. The influence

of war demands is shown by a tabulation of military uses of processed papers. A similar list of civilian uses is given. Properties to be imparted to paper by finishing and materials available for various purposes are also recorded. The resistance of films of various synthetic resins to acids, alkalis, solvents, oils and greases, water vapour, gases, etc., is tabulated. C.

**Amthor Universal Tensile Strength Tester.** Staff of the Institute of Paper Chemistry. *Paper Trade J.*, 1943, 116, No. 6, p. 10-12. A report is given of a critical examination of the Amthor tester of maximum loading capacity 200 lb. The machine is of the pendulum type and has three ranges, 0-15, 0-50 and 0-200 lb., with scales graduated in tenths, quarters and whole pounds, respectively. The greatest error found by dead-weight loading was 0.54 per cent. of the full load. C.

## 7—LAUNDERING AND DRY-CLEANING

### (A)—CLEANING

**Bleaching Agents: Use in Laundries.** A. Foulton. *Wascherei-Ber.*, 1942, 10, 51-54 (through *Chem. Zentr.*, 1942, ii, 2960 and *Chem. Abstr.*, 1944, 38, 2827). A discussion of the various bleaches (such as oxygen, sun bleaching, chloride of lime, hypochlorites). The use of chloride of lime in laundries has been practically discontinued. By comparison sodium hypochlorite solution ("Bleichessenz") is safe and easily applied. Of critical importance to the appearance of the fibre are careful control of the bleach concentration and temperature (0.3 g./l. active chlorine; temperature 30° C., maximum 40° C.; bleaching time 15 min.). Thorough rinsing out of the washing solution prior to bleaching is important since soaps of olive-, peanut-, and soybean oils consume significant amounts of active chlorine. Tallow, coconut and palm oil soaps take up chlorine more slowly and in smaller amounts. By acidifying the bleach stabilized with alkali the bleaching activity is increased and also the danger of injury to the fibre. Sodium thiosulphate can be used to wash out unpleasant smelling chloramines. C.

**Naphthenic Acids and Soaps: Application.** —. Widaly. *Seifensieder-Zig.*, 1942, 69, 211-212 (through *Chem. Zentr.*, 1942, ii, 1864 and *Chem. Abstr.*, 1944, 38, 2837). Naphthenic acids produced in the refining of petroleum, particularly Russian and Rumanian petroleum, are finding increased use in the production of soaps and other derivatives for the textile industry, in combating pests, wood preservation, lacquer formulation, etc. In the impure state naphthenic acids form an almost black, viscous liquid with a pungent odour. Naphthenic acids with an acid number of 200-275, b.p. 240-300°, iodine number 0-12, and an unsaponifiable content of approximately 10 per cent. are most appropriate for soap production. The lower the iodine number the better are the acids. One means of obtaining naphthenic acids is by extraction with dilute (5 per cent.) caustic soda of the tar acids resulting from the sulphuric acid refining of petroleum. The unpleasant odour of the acids should be easily masked with lavender and similar materials. The esters may find use in perfumes. The analysis of naphthenic acids is limited mainly to the determination of water content, acid number, iodine number, and unsaponifiables. Recipes for several soaps are given. C.

**Tergin: Properties.** G. A. Bosurgi. *Riv. ital. essenze, profumi, piante offic.*, 1942, 24, 167-169 (through *Chem. Zentr.*, 1942, ii, 2550 and *Chem. Abstr.*, 1944, 38, 2838). Tergin consists, for the most part, of pectin and cellulose, and has a high capillary activity. Like soap, it penetrates into fibres and skin pores, emulsifies impurities and fat, and removes them adsorptively. It is a good soap-extender and an effective soap substitute. C.

**Shrinkage and the Cleaner.** *Information*, 1944, Sept. Shrinkage of woollen articles in dry cleaning may be caused either by solution of synthetic resins added to the articles to prevent shrinkage or by the presence of excessive moisture in the cleaning operation. Control of moisture is discussed in detail. La.

### (C)—FINISHING

**Calender Sheeting: Longer Life.** L. A. Bradley. *Ldy Age*, 1944, August, 37-9. Ten illustrated hints for extending the life of calender sheeting. La.

## PATENT

**Apparatus for Steaming and Drying Garments.** United States Hoffman Machinery Corporation. B.P.563,715; App. 21/7/42; Acc. 28/8/44. B.P. 564,369; App. 20/3/43; Acc. 25/9/44; Conv. (U.S.), 7/3/42. Apparatus for steaming and drying garments, comprising a base portion having a foraminous member supported thereon and encompassed by a permeable fabric adapted to be inflated inside the garment to be treated, and including means for passing heating fluids through said member, fabric and garment for steaming and drying them. The second patent adds improvements to the original one so that it is easier for an unskilled operator to finish the garments properly after only a very short period of training. La.

## 8—BUILDING AND ENGINEERING

## (A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT

**Plastics: "Heatronic" Moulding.** V. E. Meharg and A. P. Mazzucchelli. *Modern Plastics*, 1944, 21, No. 10, 108-113, 160, 162. Heatronic moulding involves heating a thermo-setting moulding material uniformly throughout its mass to about moulding temperature, transferring the hot and soft mass to the heated die without loss of plasticity, and then moulding the material in the usual manner. The heating rate, the relationship between the "pre-form" temperature and available transfer time, methods of measuring the temperature, the importance of uniformity of heating and methods of ensuring it, frequency, and precautions necessary in the final moulding operation are discussed. An indication is given of the various materials to which the heatronic process is applicable, the selection of equipment is briefly discussed, and the advantages of the heatronic process are pointed out. Examples of industrial parts now made by this method are mentioned. C.

## (B)—FIRE PREVENTION

**Mill Electrical Plant: Fire Risks.** *Silk & Rayon*, 1944, 18, 1008-1011. Electrical causes of fire in mills are broadly reviewed under the headings (1) friction, (2) arcing and sparking, (3) excessive current in conductors, (4) high resistance connections and (5) leakage of current. C.

## (C)—STEAM RAISING AND POWER SUPPLY

**Combined Heat and Power Plant: Advantages.** H. E. Partridge. *Textile Manufacturer*, 1944, 70, 364-366, 369 (from *Trans. Inst. Eng. and Shipbuilders in Scotland*, 1944, June, No. 1043). The writer condemns the practice of generating electric power as a separate undertaking and stresses the economic values of combining steam raising, hot water supply and power generation in one plant. Flow sheets are given of such a plant installed at a carpet factory which showed a thermal efficiency of 73.3 per cent. over a full week's run. It is not proposed that each small factory should have such a plant, however. An industrial town of about 30,000 to 50,000 people and, say, 20 factories would find one central station sufficient, with power, steam and hot water supplied from mains. C.

**Furnace Fuel Bed: Combustion Processes.** J. R. Arthur. *Bull. British Coal Util. Res. Assoc.*, 1944, 8, 202-207. A concise review is given of a selection of the work published during the past 30 years on combustion in fuel beds. The main headings are (1) The nature of carbon/air reactions, (2) Determination of the primary oxidation product, (3) The combustion of single particles, (4) Reactivity experiments, (5) Technical-scale experiments, and (6) Theories of combustion in fuel beds. C.

**"Niagara" Mechanical Stokers.** *Textile Weekly*, 1944, 34, 346-350. Drawings are given of the "Niagara" air draught stoker and fan forced draught furnace and their advantages as fuel economisers are discussed. C.

**Drainage of Steam Mains.** S. G. Saunders. *Industrial Heating Engineer*, 1944, 6, 125-9. Adequate drainage is of major importance when considering steam mains and their lay-out, and this article considers the main features of the provision of such drainage: Charts are included to give the condensation load when starting up from cold, and heat losses from bare pipes. Typical drainage arrangements are illustrated and described. La.

## (D)—POWER TRANSMISSION

**Rubber Couplings: Application in Power Transmission.** J. H. Booth. *Mech. Eng.*, 1944, 66, 389-391, 397. The physical characteristics of rubber in couplings, and the mechanics of power transmission by rubber couplings are discussed, with special reference to the coupling designed by F. M. Guy and incorporated under the name "Layrub" or "Thompson" in racing motor cars. C.

**Springs: Vibration.** W. A. Tuplin. *Engineering*, 1944, 158, 103, 124-125. The author presents a mathematical discussion of vibration in springs with non-linear characteristics. One of the conclusions drawn is that a shaft coupling with a non-linear spring characteristic is not a safeguard against excessive torsional vibration, but may actually combine the most dangerous characteristics of linear and non-linear spring systems. C.

**Bearings: Measurement of Adhesion Component in Friction.** B. W. Sakmann, J. T. Burwell, Jr., and J. W. Irvine, Jr. *J. Appl. Physics*, 1944, 15, 459-473. A study of the exchange of material between sliding surfaces uses a radioactive tracer method by means of which it is possible to detect quantities of metal as small as  $10^{-4}$   $\mu$ g. Spherical or hemispherical specimens were slid over an activated base surface. After the friction experiments, the riders were tested for the presence of radioactive material, and the quantity of metal deposited on the rider was determined as a function of various parameters. A copper-beryllium base surface was used with riders of steel, phosphor bronze, glass, copper-beryllium, nickel and other metals. It was found that the amount of base metal adhering to the rider was proportional to the load and increased with the distance of travel. Under otherwise identical conditions the amount of base metal deposited on the rider depended on surface finish and hardness of the rider. When the rider was harder than the base the transferred material increased with surface roughness. When the rider was softer than the base, surface finish was of secondary importance. Measurements made with steel specimens showed that the amount of metal deposited on them was inversely proportional to their Brinell hardness. For riders of different materials, but having the same hardness and surface finish, the amount of transferred metal increased with the solid solubility of the base metal in that of the rider. Lubrication decreased the transfer; the reduction depended on load and, for the same load, on the material of the rider. The influence of lubrication was greater for smaller loads. C.

**Lithium Stearate: Properties and Uses.** Foote Mineral Co. *Rev. Sci. Instruments*, 1944, 15, 157. Litholite (lithium stearate) is only slightly soluble in water, but capable of forming high-melting oil gels of great stability. It is therefore effective in lubricants capable of withstanding extremes of high (400° F.) and low (-90° F.) temperatures. The presence of other fatty acids and active ions such as Na, K,  $\text{SO}_4$  and Cl affects the performance of the greases. Lithium stearate transforms low-melting (below 50° C.) paraffins from a soft sticky mass to a tough rubbery material not likely to break or chip, tending to resume its original position after bending, and with a tensile strength approximately three times that of paraffin. Paraffin waxes containing 10 per cent. of Litholite have a melting point higher than carnauba, montan, or candelilla wax (approximately 85° C.). The lithiated paraffins are dust-repellent and, with their high melting point and shock resistance, suggest electrical applications. Preliminary tests indicate that the wax gels, used as paper coatings, have marked resistance to oils. C.

**"Thymotrol" Electronic Variable-speed Drive.** S. D. Fendley. *Paper Trade J.*, 1943, 116, TAPPI, 61-65. Illustrations and wiring plans are given of the General Electric Co. "Thymotrol" panel for the electronic control of motor speeds. When the "start" button is pressed, the motor will accelerate quickly to the speed corresponding with the setting of a potentiometer and remain at this speed irrespective of variations in load within the limits of the voltage drop compensation feature. When the "stop" button is pressed the anode contactor will be dropped out and a resistor connected across the armature to bring the motor to a quick stop as the full field is applied. C.

**Tubular Extension Shafts for Valve Operation.** G. H. Pearson. *Industrial Heating Engineer*, 1944, 6, 137-40. It is frequently desirable to be able to

operate a valve from a distance and the introduction of suitable gear produces a number of problems which are discussed in this article. These include strength and support of suitable extension members with particular reference to economy in material. La.

(G)—HEATING, VENTILATION AND HUMIDIFICATION

**Dielectric Hysteresis Heating: Thermal Conduction Problems.** H. Herne. *Wireless Engineer*, 1944, 21, 377-382. A brief review is given of the literature on problems of thermal conduction encountered in heating by dielectric hysteresis effects. The general equation of heat conduction is given and its solution for the one-dimensional case is obtained by a simple and direct method and also by a more powerful method based on Duhamel's theorem of temperature distribution with variable boundary conditions. Extensions of this theorem are indicated and applied to the problem of calculating temperatures in a pack of 14 sheets of wood when heated by radio-frequency currents. C.

**Textile Plant Control Instruments: Application.** W. B. Heinz and W. W. Starke. *Mech. Eng.*, 1944, 66, 451-455; *Textile Manufacturer*, 1944, 70, 407-410. A general discussion of the scope for instrument control in the textile industry, with special reference to water tank temperatures, drying and carbonizing plant, package dyeing machines, kiers, scouring bowls, and speed and tension control. C.

(H)—WATER PURIFICATION

**Water: Purification.** A. Meyer. *Leipzig. Monats. Text. Ind.*, 1942, *Fachheft* 2, 56-58 (through *Chem. Zentr.*, 1942, ii, 2222 and *Chem. Abstr.*, 1944, 38, 2318<sup>6</sup>). A discussion of the purification of water by filtration through gravel or sand, removal of iron, manganese and carbon dioxide by base exchange or flocculation and by working with screenless centrifuge, filter press, bag filter, Kelly and Sweetland presses and settling ("Anschwemm") filters. An illustration of a settling filter plant is given. C.

(I)—WASTE DISPOSAL

**Wool Alcohol Ointments.** O. J. Hedley. *Pharm. J.*, 1943, 151, 165 (through *Chem. Abs.*, 1944, 38, 1321). A wool alcohol ointment with greater firmness and "pull" than that of the British Pharmacopoeia (these *Abs.*, 1943, A415) is proposed. Its composition is wool alcohols 30 grains, hard paraffin 120, soft paraffin 90 and liquid paraffin 240 minims. W.

**Wool Alcohols: Base for Ointments.** T. D. Whittet. *Soap, Perfumery and Cosmetics*, 1944, 17, 94-96 (through *Chem. Abs.*, 1944, 38, 2165). W.

PATENTS

**Mouldable Fibre Compositions: Production.** British Cotton Industry Research Association, S. M. Freeman, F. Brownsett, Bakelite Ltd. and N. W. Knewstubb. B.P.563,627 of 22/10/1942:23/8/1944. In a process for the preparation of a composition containing fibres for the production of moulded articles, a mixture of fibres and a resinous binder, obtained by the method and apparatus of B.P.562,308, is subjected to heat and pressure. The resinous binder may consist of a natural or synthetic resin of the thermoplastic or the thermosetting type, e.g. a polyvinyl resin or a phenol- or urea-formaldehyde resin. When a phenol-formaldehyde resin is employed it may be either of the heat-hardening type or may consist of a mixture of a potentially reactive resin with a hardening agent, such as hexamethylenetetramine. The heated mixture of fibres and resinous binder may be subjected to mechanical pressure between calendering rollers, and the consolidated product moulded in sheet or laminated form or disintegrated and moulded to form articles of more intricate shape. C.

**Air Filter.** J. Baron & Sons Ltd. and H. S. Greenwood. B.P.563,806 of 7/5/1943:30/8/1944. Improved means for filtering and distributing air in mills comprising a filter bag secured to the end of an air outlet pipe is characterised in that the material of the filter bag is woven with warp and weft of doubled or multiple yarns of jute and cotton. A suitable fabric is woven from 3s yarns and has 10 ends and 10 picks per inch. The air outlet pipe is preferably formed with a suspension flange which may be slightly bell-mouthed. The complete system for supplying and distributing filtered air includes a pipe trunk system having a number of depending branch outlet pipes adapted to receive and hold the filter bag. C.

## 9—PURE SCIENCE

**Polar Molecules: Orientation; Demonstration.** P. Pierron. *C. r. Acad. Sci.*, 1941, 212, 991-993 (through *Chem. Zentr.*, 1941, ii, 2926 and *Chem. Abstr.*, 1944, 38, 2311<sup>4</sup>). The material in question is intimately mixed with an alkaline viscose solution and the mixture is spun in the usual manner (platinum tube) into an acid precipitating bath (sulphuric acid plus sodium and zinc sulphates). Microscopic examination of the resulting fibre shows that with polar compounds the liquid is present in the interior of the thread, whereas with non-polar compounds the original homogeneity of the mixture can be observed. Non-polar compounds tested were aliphatic hydrocarbons and decalin; polar compounds included toluene, *o*-xylene, naphthalene, nitrobenzene, chlorobenzene, isomyl alcohol and tetralin. C.

**Proteins: Precipitation by Synthetic Detergents.** F. W. Putnam and H. Neurath. *J. Amer. Chem. Soc.*, 1944, 66, 692-697. Anionic detergents precipitate proteins only when the latter are in the cationic form and the maximum pH at which precipitation occurs is close to the isoelectric point. A quantitative study of the system crystalline horse serum albumin-sodium dodecyl sulphate has shown that precipitation is governed by the protein/detergent weight concentration ratio, pH, temperature and ionic strength. At low detergent concentrations the protein may be completely precipitated, whilst in regions of excess of detergent redispersion of the precipitate occurs. Dissociation of the protein-detergent complex by means of barium salts yields a protein which, as indicated by diffusion, viscosity and electrophoresis, is in a regenerated rather than in the native state. The mechanism of precipitation, and the potential application of detergents to the preparation and separation of proteins are discussed. C.

**Methyl Dilinoleate: Viscosity.** D. W. Young and R. E. Biertuempfel. *J. Amer. Chem. Soc.*, 1944, 66, 843-844. Viscosity measurements on a pure sample of methyl dilinoleate over a range of temperature from -40 to 212° F. are presented. A straight line is obtained by plotting kinematic viscosity as a function of temperature on the viscosity-temperature chart proposed by the American Society of Testing Materials (D. 341-37T). C.

**Cellulose: Effect of Ultra-violet Light.** R. A. Stillings and R. J. van Nostrand. *J. Amer. Chem. Soc.*, 1944, 66, 753-760. An apparatus for the ultra-violet irradiation of solids in powder form in various atmospheres is described, which provides for evacuation prior to exposure, continuous mixing and continuous analysis of gaseous products, and an account is given of a study of the action of ultra-violet light on cellulose. Cellulose irradiated in nitrogen with all possible precautions to remove and exclude oxygen showed considerable degradation (chiefly a drop in degree of polymerisation and  $\alpha$ -cellulose content, an increase in copper number and liberation of carbon monoxide and carbon dioxide), the amount of degradation increasing with lengthening time of exposure. These changes could not be explained simply by the presence of oxygen in the nitrogen or that retained in the cellulose at the start of the exposure. The rate of degradation increased with increased oxygen content in the atmosphere. The rates of change of chain length and copper number during irradiation in nitrogen did not correspond to the rates calculated on the assumption that the reaction was of the first-order type. Exposures of  $\beta$ -D-glucose and cellobiose likewise resulted in the production of carbon monoxide and carbon dioxide, but at a considerably slower rate than that for cellulose. No change could be detected in the reducing power of these sugars, but exposed samples showed an increased absorption of ultra-violet light. Cellulose irradiated in the absence of oxygen was left in an unstable state at the conclusion of the exposure, i.e., the changes which the cellulose underwent during irradiation continued to occur during storage when air was present, but ceased when air was absent. The post-irradiation effect was increased by raising the temperature to 70° and by replacing the air in the storage bottles with oxygen. A small portion of the increased post-irradiation effect at 70° was due to the temperature alone. The post-irradiation effect was deferred or produced at will by alternating the atmospheres several times between nitrogen and oxygen. If the time of storage in oxygen was sufficiently long, the post-irradiation effect came to an end. Cellulose which had been irradiated in the presence of oxygen still underwent the post-

irradiation reaction. However the effect was smaller and became almost negligible when the time of irradiation in oxygen was extended from four to ten days. Possible reaction mechanisms are discussed. C.

**Cellulose-Nitric Acid Compounds: Ultra-violet Absorption Spectra.** G. Champetier and R. Marton. *Bull. soc. chim.*, 1943, 10, 102-106 (through *Chem. Abstr.*, 1944, 38, 2483<sup>6</sup>). Absorption spectra between 2300 and 4350 Å. obtained by reflection are given for cellulose,  $2C_6H_{10}O_5 \cdot 2HNO_3$  (I) (from the reaction of nitric acid ( $d$  1.415) on cellulose),  $2C_6H_{10}O_5 \cdot HNO_3$  (II) (from I by drying over calcium oxide), and for nitrocelluloses containing 11 per cent. (III), 12 per cent. (IV) and 13 per cent. (V) nitrogen; I shows a band between 2570 and 2850 Å, and II at 2700-3050 Å.; but III, IV and V show no selective absorption, but an undulation of the curve. Compounds I and II are therefore chemical individuals. On treatment with water they regenerate a cellulose with the same spectrum as mercerised cellulose. C.

**Colour Aptitude Test.** F. L. Dimmick. *Textile World*, 1944, 94, No. 5, 84-85. Steps in the development of a "colour aptitude" test by the Inter-Society Colour Council (U.S.A.) are outlined. In its present form 50 coloured rectangles are arranged haphazard on a gray background and have to be matched within half an hour by loose chips ( $1\frac{1}{8} \times 1$  inch) taken one by one from a flat holder in which they are invisible. The tested chip is replaced at one end of the holder and this action expels the next chip from the other end. The set covers the range of Munsell chroma from 4 to 5, that is, the test is a "colourful" one. The whole apparatus folds up into a space of  $12 \times 18 \times \frac{3}{4}$  inch. Scoring is on a per cent. basis and the best matchers reach figures just above 90 per cent. Mention is made of plans to test large numbers of observers. C.

**Positive Displacement Flowmeter.** J. McAfee. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 303. A simple flowmeter which is applicable over wide ranges of temperature, pressure and stream composition consists essentially of a U-tube, one leg of which is a gauge glass and the other a reservoir for mercury, water or other liquid heavier than and immiscible with the flowing stream. The U-tube is connected to valves which in turn join the line carrying the stream to be measured. A third valve is introduced in the line between the connections to the U-tube. Before the gauge glass is connected, its volume between two convenient markings is determined. To measure the flow rate the valves are adjusted so that the oil (or other fluid being measured) is forced into the mercury reservoir, the mercury into the gauge glass, and oil out of the gauge glass into the main line. Since as much oil is forced out of the system as enters, the net rate of flow in the main line remains unchanged. The measurement itself consists in determining the time required for the mercury level to rise from one calibration mark to the other, thus filling a known volume. If the calibrated volume is  $V$  gallons, and the time required to fill it is  $t$  minutes, the rate of flow,  $R$ , in gallons per minute, is given by the equation  $R = V/t$ . The device can also be used for measuring gas streams if proper account is taken of the compression of the gas on the upstream side of the meter, a low-density scaling liquid is used, and the variation in liquid level is limited to a low value. C.

**Powdered Solids: Analysis by X-ray Diffraction.** L. K. Frevel. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 209-218. Chemical analysis by the powder diffraction method consists of matching the X-ray diffraction pattern of an unknown material with one or more standard powder patterns. This requires (1) a correct registration and measurement of the diffraction lines and (2) a careful interpretation and evaluation of these data as applied to chemical analysis. Complications involved in these operations are discussed. Absorption edges, fluorescence, resolution, absorption, preparation of specimen, validity of standard patterns, and classification of standards are considered. Powder diffraction data are given for various compounds, and applications of the method are discussed. Advantages of combining spectroscopic information with diffraction data are pointed out. C.

**Keratins: Comparative Chemical Study.** T. P. Salo. *Thesis, Univ. of Michigan*, 1942 (through *Biol. Abs.*, 1944, B, 8089). Existing methods for the analysis of amino acids in proteins have been investigated, and modified for investigating the amino acid composition of keratin hydrolysates. Tyrosine, tryptophane, phenylalanine, cystine, methionine, threonine, histidine, lysine and arginine



were determined, and also moisture, ash, nitrogen and sulphur. The results of the analysis of 18 different animal integuments (corrected for moisture and ash) are reported. The nitrogen content varies from 15.1 per cent. in turkey and duck fan to 16.57 per cent. in horsehair. Snake skin is lowest in sulphur content (1.9 per cent.), and dog hair highest (5.22 per cent.). The class *Reptilia*, as represented by a single specimen of snake skin, has the highest tyrosine content (6.64 per cent.). The class *Aves* has the lowest content of tryptophane 0.24-0.35 per cent.), and the class *Reptilia* the highest (1.2 per cent.). Goose fan is lowest in phenylalanine content (1.15 per cent.). The cystine contents of the integuments range from 5.56 per cent. in the snake skin to 18.31 per cent. in dog hair, in accordance with their sulphur contents. The methionine contents range from 0.43 per cent. in the duck fan to 1.33 per cent. in the wool of the mountain sheep. Histidine varies from 0.39 per cent. in the duck fan to 0.97 per cent. in grey fox hair; lysine varies from 1.87 per cent. in sika deer hair to 6.28 per cent. in snake skin. Arginine is highest in the Virginia deer hair (10.38 per cent.) and lowest in the duck fan (5.22 per cent.). For the mammalian hairs the average molecular ratios of histidine:lysine:arginine are approx. 1:4:10. The molecular ratios of all the amino acids to tryptophane were calculated, since, of the amino acids determined, this was present uniformly in small amounts. The ratios of cystine to tyrosine, and threonine to tryptophane in feathers were significantly higher than similar ratios for the other integuments. The various structures studied may be provisionally classified into 3 groups in accordance with the amounts of the various amino acids present:—(1) the hair of mammals, (2) the feathers of birds, and (3) porcupine quills, snake skin and human skin. Differences among the 3 groups have already been indicated by the work of Astbury and co-workers on the X-ray spacings of keratins from different sources. W.

**Livestock Insect Control.** E. G. Thomssen and M. H. Doner. *Soap*, 1943, 19, No. 11, 96-103, 117, No. 12, 131-141. A comprehensive account of the common flying and crawling insects that attack livestock, of their effect on the animal and on animal by-products, e.g. hides, hair and wool, and of methods of control, including the treatment of infested premises. A table gives the formulæ of various dips. W.

**Dry Grinding: Effect on Properties of Keratins.** H. R. Cohen. *Archives of Biochem.*, 1944, 4, 145-150. Wool and ox-horn keratin both yield water-soluble protein upon grinding. The fractions contain no tryptophan. The nitrogen content decreases in successive water-soluble fractions. The protein contains high percentages of dialyzable material, this indicating that the fragments are of small molecular size. W.

**Silkworm Eggs: Treatment with Hydrochloric Acid.** M. Craiciu. *Atti mem. accad. sci. Padova*, 1942, 57, 91-101 (through *Chem. Zentr.*, 1942, ii, 2922 and *Chem. Abstr.*, 1944, 38, 2754<sup>4</sup>). Hydrochloric acid has a chemical action on the egg membranes, since after treatment the carbohydrates and proteins become more soluble in water. The air channels are enlarged by hydrochloric acid so that respiration of the eggs is more intense and the development of the embryo accelerated. After acid treatment a larger number of amino acids are present in the egg proteins; these are necessary for the development of the embryo. The formation of vitellin is accelerated which also accelerates development of the embryo. C.

**Amylopectin: Synthesis.** W. N. Haworth, S. Peat and E. J. Bourne. *Nature*, 1944, 154, 236. The authors report the isolation from the potato of an enzyme system that converts glucose-1-phosphate into a polysaccharide which is certainly not amylose, but resembles amylopectin in all the tests so far applied. C.

**Cellulose: Aerobic Decomposition by Thermophilic Bacteria.** H. C. Murray. *J. Bact.*, 1944, 47, 117-122 (through *Chem. Abstr.*, 1944, 38, 2687<sup>9</sup>). Cultures of bacteria which attacked filter paper under aerobic conditions at 60° were inhibited under anaerobic conditions. A common difficulty in growing cultures of cellulose splitters aerobically is low humidity. Saturation of the atmosphere with water seems necessary for optimum growth. The use of 0.8 per cent. agar gave more intensive digestions than did higher concentrations. Placing a layer of non-inoculated 2.0 per cent. agar in the bottom of the Petri dish and then pouring on an inoculated layer of 0.8 per cent. agar permits the dish to be inverted for incubation. C.



**Cellulosic Fibres: Resistance to Micro-organisms.** L. A. Kusyurina. *Microbiology* (U.S.S.R.), 1941, 10, 752-761 (through *Chem. Zentr.*, 1942, ii, 2157 and *Chem. Abstr.*, 1944, 38, 2825<sup>5</sup>). The resistance of flax, hemp, jute and kenaph to *Myxococcus hutchinsonii*, *Cellvibrio vulgaris*, *Trichoderma lignorum* and thermophilic anaerobic cellulose bacteria was studied. Flax and hemp fibres are decomposed most rapidly, but kenaph and jute fibres are much more resistant. C.

**Asbestos: Hygroscopic Behaviour; Influence in Organic Analysis.** J. Lindner. *Ber. deut. chem. Ges.*, 1943, 76B, 701-708 (through *Chem. Abstr.*, 1944, 38, 2586<sup>4</sup>). Numerous experiments with washed and purified asbestos show that errors in the determination of hydrogen in organic compounds can often be traced to the hygroscopicity of the asbestos and the slow rate at which it gives off absorbed moisture. The data presented describe the attraction and retention of water to and by asbestos at various temperatures. C.

**Polarographic Analysis: Recent Developments.** J. E. Page. *Nature*, 1944, 154, 199-202. A concise review of the principles of polarographic analysis with special reference to its applications in biochemistry. C.

**Malt Extracts: Analysis; Application of Statistical Methods.** C. H. Goulden. *Cereal Chemistry*, 1944, 21, 159-171. It is pointed out that there is a very close relation between methods of analysis and experimental design and that a study of different methods of analysis may suggest new designs or changes in others. Covariance analysis is illustrated by a study of the correlation between total nitrogen and saccharifying activity of the malt extracts for 12 varieties of barley grown at 12 stations distributed across Canada. The procedure of splitting up degrees of freedom in the analysis of variance is described, and an example is given showing how the maximum amount of information can be extracted from an experiment in which one of the factors is tested at various levels. Reference is made to the possibility of simplifying calculations by careful selection of levels in a factorial experiment. C.

**Cellulose: Esterification by Acid and Acid Anhydride Vapours.** G. Champetier and M. Foex. *Bull. soc. chim.*, 1942, 9, 711-713 (through *Chem. Abstr.*, 1944, 38, 3125<sup>4</sup>). The extent of nitration decreases rapidly with decreasing nitric acid content of vapour, becoming nil below 66 per cent. Vapours of formic acid and acetic acid give low esterification, comparable with that obtained with the liquid acids in the absence of dehydrating agents. Vapours of acetic anhydride give a more vigorous acetylation than acetic acid; the degree of esterification increases with temperature, reaching 16.6 per cent. acetyl in 200 hours at 150° and 760 mm. C.

**Cellulose: Iodine Adsorption.** A. Boutaric and Suzanne Anglade-Thévenet. *Bull. soc. chim.*, 1942, 9, 782-785 (through *Chem. Abstr.*, 1944, 38, 3124<sup>9</sup>). Spectrophotometric measurements were used in studying the blue sorption product formed between iodine in potassium iodide and cellulose (ashless filter paper dissolved in zinc chloride and fuming hydrochloric acid). The concentrations of the three components were varied one at a time and the effect on the spectral absorption curves was noted. The effect of time was also studied. The interaction between cellulose and iodine is very different from that giving the nearly instantaneous blue coloration between starch and iodine. The cellulose-iodine reaction takes place progressively, and the optical density at the wave length 520 m $\mu$  increases with time and reaches a limiting value at the end of 45 minutes, which is maintained for several hours and then gradually decreases. With rising opacity, the colour of the system shifts further and further into the violet. Taken collectively, the data indicate that the cellulose-potassium iodide-iodine system does not obey Beer's law (which is obeyed approximately by the starch-iodine system). C.

**Cellulose: Iodine Adsorption.** A. Boutaric and S. Fabry. *Bull. soc. chim.*, 1942, 9, 835-840 (through *Chem. Abstr.*, 1944, 38, 3125<sup>2</sup>). Capillary rise measurements were made with ashless filter paper strips which permitted the study of iodine sorption by cellulose. There is a rapid rise of the colourless solvent to height  $H$  and a slower rise of the iodine to height  $h$  as shown by the formation of a reproducible blue zone.  $H$  and  $h$  were measured at various time intervals and  $H/h$  remained nearly constant. The Freundlich adsorption isotherm was approached in all cases. Adsorption, however, varied when varying amounts of potassium iodide, ethyl alcohol, methyl acetate, acetic acid, hydrochloric

acid or caustic soda were added to the iodine solutions. Detailed tabulated data are given.

C.

**Cellulose Acetate: Precipitation.** M. Takei and H. Erbring. *Kolloid Z.*, 1942, 101, 59-64 (through *Chem. Zentr.*, 1943, i, 513-514 and *Chem. Abstr.*, 1944, 38, 3125<sup>9</sup>). Titration of cellulose acetate in acetone, methylglycol acetate, dioxane, diethyl lactate, acetic anhydride, aniline, and dichloroacetic acid with methyl alcohol gave a practically constant value for  $\gamma$  of 0.69 for the relation between the nature of the solution and the methyl alcohol concentration required to cause precipitation, which may be ascribed to the de-associating effect of the methyl alcohol. With benzene and heptane for precipitation, the solutions may be arranged in three classes. Acetone, methylglycol acetate and dioxane showed the smallest  $\gamma$  value (about 0.2 for benzene), followed by diethyl lactate, acetic anhydride and aniline ( $\gamma$  value, 0.6), and finally by dichloroacetic acid ( $\gamma$  value, 0.8). This difference is ascribed to the formation of secondary particles of varying structure. The dielectric solvation numbers agree, almost without exception, with the  $\gamma$  values. The de-associating influence of methyl alcohol upon addition of solutions of cellulose acetate is shown by the turbidity curves. Upon complete titration of all fractions with benzene, the solutions with the smallest  $\gamma$  values show, as expected, a precipitation range which comprises a narrower concentration range than do solutions with larger  $\gamma$  values. The lim.  $\eta_{sp}/c$  values for acetone, diethyl lactate and aniline are given; aniline

$\xrightarrow{c \rightarrow 0}$  shows the highest and acetone the lowest value. These results show that the state of solution in the original solution of cellulose acetate cannot be deduced from the precipitability with methyl alcohol, whereas the results obtained with benzene give a better picture.

C.

**Cellulose Esters and Ethers: Acetone and Water Absorption.** L. Clément and C. Rivi  re. *Bull. soc. chim.*, 1943, 10, 386-396 (through *Chem. Abstr.*, 1944, 38, 2817<sup>8</sup>). Mixtures containing 80, 70, 60, 50, 40, 30, 20 and 10 per cent. by volume of acetone in water were allowed to stand several days with the cellulose derivative (100 c.c. with 10 g.) and the amount of water or acetone absorbed was determined by pressing out the solution in stages, and determining the composition of the expressed liquid by its density. When plotted against the volume extracted, the compositions of the expressed liquids obtained from one initial solution lie on a straight line, and compound formation is shown by the convergence of the lines for several solutions. The point of convergence is calculated from the equation of the straight lines. Each cellulose derivative formed two compounds, those for cellulose nitrate containing 2.2 and 1.1 mol. acetone per mol. and no water; cellulose acetate, 3 mol. acetone per 2 mol., and 3 mol. acetone+8 mol. water per mol.; cellulose triacetate, 3 mol. and 1.5 mol. acetone per mol., no water; ethylcellulose, 3 mol. acetone per 2 mol. and 3 mol. acetone+8 mol. water per 4 mol.; benzylcellulose, 2 mol. acetone per mol. and 1 mol. acetone+2 mol. water per mol.

C.

**Cottonseed Pigments: Nature and Properties.** C. H. Boatner. *Oil and Soap*, 1944, 21, 10-15 (through *Brit. Chem. Physiol. Abstr.*, 1944, A III, 444). In addition to gossypol, three further pigments have been identified in cottonseed, (1) a red pigment that appears to be a quinonoid oxidation product of gossypol, (2) an oil-soluble yellow pigment, and (3) a purple pigment, named "gossypurpurin," with bands at 525 and 560 m $\mu$ . The properties of these pigments are discussed.

C.

**Dextran and Levan: Electron Microscopy.** B. Ingelman and K. Siegbahn. *Nature*, 1944, 154, 237-238. Photographs ( $\times 30,000$ ) of dextran under electron-optical magnification of 7,000 show in places uniform thin threads 30-100 A thick, some of which display nodes about 800 A apart, i.e. at intervals of about 160 glucose units. The estimated molecular thickness of dextran, from physico-chemical evidence, is about 50 A. Levan, obtained by seeding fructose with a culture of *B. vulgaris*, shows at  $\times 35,000$  compact structures. In the ultracentrifuge, the preparation gave reproducible sedimentation constants of  $200-300 \times 10^{-13}$  and diffusion constants of  $0.2 \times 10^{-7}$ , corresponding with molecular weights of the order of 100 million.

C.

**Methylated Methylglycosides: Chromatographic Separation in End-group Determinations.** J. K. N. Jones. *J. Chem. Soc.*, 1944, 333-334. The method of "chromatographic" adsorption on activated alumina from solution in mix-

tures of ether and light petroleum is shown to lead to the quantitative separation of tetramethyl- from trimethyl-methylglycosides, a step that is often required in the determination of end-groups in methylated polysaccharides. By means of the new technique it is shown that the repeating units of methylated banana and rice starches have 26 and 33 glucose residues, respectively. C.

**Acrylate and Vinyl Chloride Resin Dispersions: Preparation, Properties and Uses.** A. Renfrew and C. F. Flint. *Trans. Inst. Rubber Ind.*, 1944, 19, 213-222. The preparation of aqueous dispersions of polymethyl methacrylate and polyvinyl chloride is briefly described and the properties of these dispersions and of films formed from them are compared with the properties of rubber latex and latex films. Dispersions of plasticised polymethyl methacrylate are rather unsatisfactory substitutes for rubber latex. Their main applications are for bonding and finishing in the textile industry. Suitably plasticised aqueous dispersions of polyvinyl chloride show promise as rubber latex substitutes. They can be handled by a technique similar to that used with ordinary rubber latex and yield films showing remarkably rubber-like properties. The films are strong, supple and water-resistant, but somewhat deficient in tear resistance, less extensible than rubber, and not suitable for use at high temperatures. The preparation, properties and applications of dispersions of mixed polymers of vinyl chloride and methyl methacrylate, and of the dispersions of polyvinyl chloride in plasticiser (e.g. tricresyl phosphate), known as "Welvic" pastes, are also discussed. C.

**Di-*p*-chlorophenyltrichloroethane Insecticide (D.D.T.): Production and Properties.** G. A. Campbell and T. F. West. *Chemistry and Industry*, 1944, 319. A brief statement of the history of di-*p*-chlorophenyltrichloroethane,  $(C_6H_4Cl)_2 \cdot CH \cdot CCl_3$ , and its remarkable insecticidal action. It is conveniently prepared by condensing chloral with *p*-chlorobenzene in sulphuric acid monohydrate. Production early in 1945 is expected to reach 1,700,000 lb. per month. Clothing impregnated with a D.D.T. solution of suitable strength withstands 6-8 launderings and can be worn 6-8 weeks before losing its toxic activity towards a wide variety of pests. C.

**Fatty Acids: Low Temperature Saponification in Anhydrous Systems.** W. Gallay and I. E. Puddington. *Canadian J. Res.*, 1944, 22, B, 76-89. Finely dispersed sodium hydroxide, suspended in mineral oil, was used to saponify fatty acids and fats in mineral oil solution. Saponification of the acids was carried rapidly to completion at 60° C. The properties of the resultant soap suspensions in oil are discussed. The degree of saturation of the fatty acids or fats is of importance in the viscosity of the suspension formed. Low molecular weight fatty acids down to acetic were also saponified by this method. Of various fats used, only mutton tallow was completely saponified at low temperature (60° C.). Finely dispersed calcium hydroxide in mineral oil suspension effects complete saponification of fatty acids in mineral oil solution at 50° C. and of mutton tallow at a somewhat higher temperature. The effect of degree of unsaturation, and the use of other fats are discussed. Small quantities of added water are shown to promote saponification. This procedure has also been used to prepare suspensions in oil of Al, Mg, Ba, Pb and Li soaps. Some properties of the suspensions are described. C.

**Linoleic and Linolenic Acid Glycerides: Preparation and Properties.** B. F. Daubert and A. R. Baldwin. *J. Amer. Chem. Soc.*, 1944, 66, 997-1000. 1-Monolinolein, 1-monolinolenin, trilinolein and trilinolenin were prepared by the action of linoleyl and linolenyl chlorides on glycerol. Physical and chemical characteristics of the products are reported. Warming curves show the existence of two polymorphic forms of each of these compounds. Bromination of the glycerides yielded crystalline bromides. Melting point data are given. C.

**Polyvinyl Derivative Emulsions: Preparation, Properties and Uses.** J. E. O. Mayne. *Trans. Inst. Rubber Ind.*, 1944, 19, 196-200. A general account is given of the production of polyvinyl acetate and various derivatives, such as polyvinyl alcohol and polyvinyl acetals, and of the preparation, properties and uses of emulsions of these products. C.

**Sodium Soaps: Recrystallization in Mineral Oils.** W. Gallay and I. E. Puddington. *Canadian J. Res.*, 1944, 22, B, 90-102. The effect of the following

factors on the recrystallization of sodium soaps in mineral oils is described: rate of cooling, acidity and alkalinity of the soap, polarity of the oil, additives such as glycerol, and external shearing forces. Non-polar mineral oil acts as an inert diluent and recrystallization is essentially that from a hot melt. The presence of polar compounds results in some solvent action on soap in the mesomorphic states, and the effect of shear on the form of the recrystallized soap in such systems is important. The preparation of a sodium soap lubricating grease is essentially a recrystallization of the soap, and the properties of the grease can be altered over a wide range by suitable adjustment of the factors during the recrystallization. C.

**Sodium Soaps: Recrystallization in Mineral Oils; Effect of Shearing Stresses.** W. Gallay and I. E. Puddington. *Canadian J. Res.*, 1944, 22, B, 103-108. High shearing stresses obtained by the use of the colloid mill are shown to bring about recrystallization of sodium soaps at temperatures above the plasticity point of the soap. Below this temperature a comminuting action only on the soap in suspension is obtained. The length of soap fibre produced in the recrystallization increases with increase in polarity of the oil and with decrease in viscosity of the oil. The fibre length increases rapidly with increase of degree of unsaturation of the soap. The addition of glycerol or fatty acid has little effect. The action of the shearing stress is discussed and the conclusion is reached that long crystals are produced by a shearing of the double soap molecules on slip planes between melted hydrocarbon chains. The recrystallization is thus induced on molten portions of the soap. C.

**"Gravity" Dialyser.** J. S. Falconer and D. B. Taylor. *Nature*, 1944, 154, 87-88. A description is given of an apparatus for dialysis at low temperatures in which the movement of the liquid that is required to increase the speed of dialysis is obtained by taking advantage of the greater density of the liquid that streams out of the sac. The advantage is that the apparatus is compact enough to stand inside a laboratory refrigerator. The sac is placed inside a vessel about 15 cm. long and 3.5 cm. diameter, drawn out at the bottom to a jet, about 0.4 mm. diameter. This vessel is supported in a vessel about 40 cm. high and 7.5 cm. diameter, containing the water. A syphon connects the inner and outer vessels. The process continues for 24 to 48 hours, until the dense salt solution has risen to the level of the jet. C.

**Lauric Acid Solution in Hexane: Interfacial Tension against Water; Ageing Effect.** A. F. H. Ward and L. Tordai. *Nature*, 1944, 154, 146. The interfacial tension between water and solutions in hexane of long-chain amphipathic substances (e.g. lauric acid) has been studied by the pendent drop method which permits continuous readings to be made without disturbing the surface. An effect of age is demonstrated; the tension falls rapidly at first and then slowly reaches an equilibrium value after some days. The final value is quickly reached by raising the temperature and the course of the change is modified by the presence of electrolytes in the water. C.

**Soap-Mineral Oil Dispersions: Fibre Structure.** W. Gallay, I. E. Puddington and J. S. Tapp. *Canadian J. Res.*, 1944, 22 B, 66-75. The texture and other physical properties of soap dispersions in mineral oil, or lubricating greases, depend largely on the degree of dispersion of the soap. Calcium and aluminium soap dispersions yield in general a very unctuous product owing to the small size of the soap fibres in these systems. Sodium soap dispersions show a wide range of texture from smooth to fibrous, and this is related to the dimensions of the soap fibres in the dispersion. The microscopic examination of these fibres is discussed and a novel dry slide technique is described. Photomicrographs are given. The effects of agitation, flow, and other mechanical treatments are considered and the growth of fibres by orientation and overlapping of smaller fibrils is described. The results of investigations, by means of the micro-manipulator, of dispersions of soap and of rayon, milkweed and sulphite pulp fibres in mineral oil are reported. The effect of glycerol, present in greases manufactured from fats, is shown to be essential for the production of long fibres in sodium base greases, and this effect is ascribed mainly to the ability of oil to wet the soap in the presence of glycerol. C.

**Colloidal Molecules: Viscosity.** H. Staudinger. *Chem.-Ztg.*, 1942, 66, 380-385 (through *Chem. Zentr.*, 1942, ii, 2891 and *Chem. Abstr.*, 1944, 38, 2547<sup>9</sup>). The investigations made to date in the field of the molecular colloids are summarised.

(The present paper is No. 300 in Staudinger's series.) The viscosity number for macromolecular substances, as for low-molecular substances, is a characteristic quantity which in connection with the molecular weight can give information concerning the form of the molecule. Numerous literature references are given.

C.

**Sodium Oleate Solutions: Viscosity.** G. Rossi and M. Ragno. *Atti accad. Gioenia sci. nat. Catania* [6], Pt. IV, Mem. 14, 8 pp., 1939-40 (through *Chem. Zentr.*, 1941, ii, 2927 and *Chem. Abstr.*, 1944, 38, 2545<sup>7</sup>). According to Einstein the viscosity of dispersed solutions obeys the law  $\eta = \eta_0(1 + 2.5v)$  where  $\eta$  and  $\eta_0$  are the viscosities of the solution and the solvent, respectively, and  $v$  = the volume of the dispersed substance per unit volume of the solution. According to the Duclaux and Nodzu modification of Arrhenius' formula  $\log \eta/\eta_0 = KC$ , where  $K$  is a constant and  $C$  is the molecular concentration. The viscosity was measured for a 3.5 per cent. aqueous solution of sodium oleate and for aqueous alcoholic solutions of various alcohol concentrations from 23.25 to 95.0 per cent. by volume. By calculation of the values of  $v$  and  $K$  and plotting them against the alcohol concentration of the solution it was found that the curves go through a distinct minimum at an alcohol concentration of 71.25 per cent. by volume. The experimental results show that the sodium oleate is surrounded by a layer of solvent which in the purely aqueous solution consists of water. From the decrease of  $v$  or  $K$  with increasing alcohol content the conclusion is drawn that the alcohol decreases the amount of water adsorbed by the sodium oleate particles. At the minimum neither alcohol nor water is adsorbed. At the higher alcohol concentration an adsorption of alcohol takes place.

C.

**Wheat Starches: Gel Strength; Varietal Differences.** R. H. Harris, L. D. Sibbitt and Harriet Toman. *Food Research*, 1944, 9, 83-88 (through *Chem. Abstr.*, 1944, 38, 2697<sup>2</sup>). Some varieties of hard red spring wheat produce starches of higher gel strength than others. The environment during the formation of the kernel has an influence upon this property of wheat starch.

C.

**Duboscq-type Fluorometer.** W. Koch. *Nature*, 1944, 154, 239. The writer describes a simple adaptation of the Duboscq colorimeter for dealing with fluorescence colours. The light source is a 220-volt "Hanovia" U-shaped burner. The radiation passes through a Wood's filter and water or saturated copper sulphate solution in a 500 ml. flask and thence to the two cups of the colorimeter.

C.

**Colour: Psychophysics.** Committee on Colorimetry, Optical Society of America. *J. Optical Soc. America*, 1944, 34, 245-266. This report deals with definitions of light and colour, colours assigned to objects, chromaticity, luminosity, determination of luminosity data, dependence of luminosity data on conditions of observation, individual variations of luminosity data, standard luminosity data, relative luminous efficiency, absolute luminous efficiency of radiant energy, luminous flux, energy, density and intensity, luminance, luminous emittance, illuminance, retinal illuminance, luminous reflectance, directional luminous reflectance, specular luminar reflectance, luminous transmittance, directional luminous transmittance, measurement of chromaticity, three-colour method of colorimetry, three-colour mixture and matching, three-colour mixture data for matching spectrum colours, non-negative colour-mixture curves, additivity of luminance for different colours, luminosity coefficients of colour-mixture curves, individual variations of colour-mixture curves, standard colour-mixture data, significance of standard data for non-standard observers, colour-mixture data in relation to theories of colour vision, tristimulus values, computation of tristimulus values of any colour, specification of chromaticity in chromaticity diagram, description of colour mixtures in terms of chromaticity diagram, achromatic stimuli, dominant wave-length and purity, and interpretation of chromaticity differences.

C.

**Cord Hanging in Festoons: Distribution of the "Slack."** E. H. Neville. *Phil. Mag.*, 1944, [vii], 35, 414-419. Under the title "Exercises on a Tight-rope," the author deals mathematically with the problem of how the slack in a cord is shared between the separate festoons when the cord is supported at intermediate points, as by a series of smooth rings. A general result is that "If a uniform rope that is almost tight hangs in festoons through any number of smooth rings, then, to a first approximation, the ratio of the length of slack in any festoon to the chord of the festoon is proportional to the square of the

horizontal span of the festoon." In a particular case the result is obtained that "If a uniform tightrope passes through any number of smooth rings which are all collinear or all in the same horizontal plane, then, to a first approximation, the length of slack in a festoon is proportional to the cube of the span of that festoon." C.

**Plasticized Cellulose Derivatives: Flow under Compression and Extension.**

D. D. Eley and D. C. Pepper. *Nature*, 1944, 154, 52. According to the place-exchange theory of plastic flow as applied by Eyring to polymers (1943), the rate of flow,  $\theta$ , should be related to the stress,  $f$ , by the equation  $\ln \theta = a + b'f$ . The authors have found, however, in a long series of measurements on a plasticized cellulose derivative over a stress range of 2-160 kgm. per sq. cm. and a temperature range of 16-100° C. (cylinders under compression and rods under stretch) that the equation only holds up to a certain stress value,  $f_0$ . In the range from a value of  $f$  of 4.6 kgm. cm.<sup>-2</sup> up to  $f_0$ , the "activation energy" for flow falls from about 30 k.cal. to about 11 k.cal. and then becomes independent of stress. In this lower region of stress the flow may actually be described by Bingham's equation for the flow of solid/liquid dispersions in capillary tubes,  $\theta = A(f - f_0)$ . The authors did not obtain any indication of a true yield value. Over a temperature range of 40° C., the "mobility constant"  $A$  and the intercept  $f_0$  depended on temperature in the same way. Strain-hardening was observed in rods under low stretch,  $\theta$  falling 20-30 fold over the initial 3-4 per cent. extension and reaching a steady value, as reported by Andrade for wires. No such behaviour was observed with cylinders under compression. C.

**Silk Cocoons of Different Races: Ratio of Sericin Fractions.** C. Manunta.

*Seta*, 1942, 48, 24-26 (through *Chem. Zentr.*, 1943, i, 582 and *Chem. Abstr.*, 1944, 38, 3138<sup>4</sup>). Sericin B precipitates from solution mainly at pH 3.6 to 4.0; sericin A is precipitated from the filtrate by means of alcohol. Sericin A contains up to 37 per cent. nitrogen, sericin B only 16 per cent. The content of melanine nitrogen in sericin B is five times as large as that in sericin A, the content of carbohydrates three to four times as large. The results of chemical analyses are tabulated. C.

**Cellulose-decomposing Bacteria: Action.** R. Y. Stanier. *Soil Science*, 1942,

53, 479-480 (through *Exp. Sta. Rec.*, 1943, 88, 305). The author has established conditions such that *Sporocytophaga myxococcoides*, *Cytophaga hutchinsoni*, and *C. rubra* all grew excellently in a mineral medium with filtered dextrose as the sole carbon source in quantities ranging from 0.1 to 0.5 per cent. The filtered dextrose did not exert a toxic effect on growth in the presence of cellulose, although with the higher concentrations of dextrose the attack on the cellulose was diminished, apparently because of a preferential utilisation of the monosaccharide. The similarity in the rates of cellulose, cellobiose and dextrose oxidation by *C. hutchinsoni* indicates that cellulose is decomposed by an initial break-down to, and subsequent oxidation of, the constituent monosaccharide. C.

**Cotton: Use as Culture Medium.** E. J. Bottcher and H. J. Conn. *J. Bacteriology*, 1942, 44, No. 1, 137 (through *Exp. Sta. Rec.*, 1943, 88, 305).

Because of the importance of soil actinomycetes in the production of antibiotic substances, attention has been directed toward the finding of a substitute for agar which would be a more satisfactory medium for the growth of the organisms. Materials investigated included sand, glass beads, gypsum blocks, and cotton. Cotton proved to be the most satisfactory; it can be saturated with a culture fluid, and although it does not form a gel, it gives the organisms a point of attachment and allows good aeration. C.

**Ozone: Toxicity; Influence of Nitrogen Oxides.** R. D. Watson. *Ind. Eng. Chem.*, 1944, 36, 559-561.

An account is given of experiments which have shown that ozone is the toxic agent in ozonized air, and that there is no measurable difference in the toxicity to *Sclerotinia fructicola* and *Escherichia coli* of ozone produced from pure oxygen and from air when used at the same concentration. Nitrogen oxides have no direct effect on the toxicity of ozone. Additions of nitrous oxide and nitrogen pentoxide to ozone have no influence on the toxicity of ozone to *S. fructicola* spores. Of the possible nitrogen oxides that might be produced by ozonizing air, only nitrous oxide and

nitrogen pentoxide could exist in the presence of ozone. Nitrogen pentoxide was produced by the ozonizers used in the experiments but oxides that form nitrous acid, nitrogen dioxide and nitrogen trioxide, were absent. Nitrogen oxides may affect the acidity of the test medium, in which case there could be an indirect influence on the toxicity of ozone to fungi. The acidity of the medium has a relatively unimportant effect on the toxicity of ozone over the pH range 4.3 to 7.95, but below 4.3 there is an interaction between ozone and the acid in the medium which results in a large decrease in germination of the treated spores. C.

**Humidity Cabinet.** F. Todd. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 394-397. A humidity cabinet for accelerated corrosion tests under extreme indoor conditions is described and shown in diagrams and photographs. It consists essentially of a vapour-tight jacketed cylindrical container with a conical bottom and top. The walls and bottom are heated by hot vapours of cyclopentane. The conical base of the cabinet is filled with water which is maintained at a constant level and the air used in the cabinet is preheated to the temperature of the cabinet and prehumidified to 100 per cent. before it enters the cabinet. Means are provided for automatically controlling the supply of air and water. The test panels are supported by hooks on concentric rings. The advantages of this design are pointed out and corrosion test data are given showing the differences in performance between this cabinet and a cabinet of conventional type. C.

**Starch Indicator Solution: Preparation.** W. S. Platner. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 369. For the preparation of a stable starch solution for use in iodometric titrations, including the Winkler determination of dissolved oxygen, a 20 per cent. solution of Na or K hydroxide, or the solid caustic alkali, is added with stirring to a suspension of about 2 g. of powdered starch in 300 to 400 ml. of water until a thick, syrupy, almost clear solution is obtained. About 30 ml. of 20 per cent. potassium hydroxide are required to treat approximately 2 g. of potato starch. The solution is allowed to stand for about an hour and then made neutral or slightly acid with concentrated hydrochloric acid. If acidity does not interfere with the proposed titration (the final sample in dissolved oxygen titration by the Winkler method is acidic), 1 ml. of glacial acetic acid is added as a preservative. A solution prepared by this method has been used over a period of 12 months without deterioration, mould growth, loss of potency, or production of reddish colour in iodometric titrations for dissolved oxygen. Tests have shown that this method of preparation yields a solution which develops and maintains greater depth of colour and has a sharper end point than starch solutions prepared by other methods. C.

**Wijs Solution: Stability.** F. A. Norris and R. J. Buswell. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 417. Wijs solution was stored at room temperature in 250-ml. dark bottles. The solution was prepared in the standard manner and contained 1.5 per cent. excess equivalents of iodine over chlorine. Iodine number determinations were made on linseed oil stored in an ice box. Over a total period of 505 days, the Wijs solution did not change sufficiently to cause a measurable difference in the iodine number of the oil. No measurable differences were found when the reagent was taken from bottles that had been previously opened. These results indicate that the solution can be stored for a year or more in small bottles which are opened as required. C.

**Chlorate Ion: Rapid Determination.** A. J. Boyle, V. V. Hughey and C. C. Casto. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 370-371. A rapid method for the determination of chlorate in cell liquor which is produced during the manufacture of chlorine consists of reducing the chlorate ion in 40 per cent. hydrochloric acid by volume with a standard ferrous ammonium sulphate solution. A few drops of a 10 per cent. solution of ammonium molybdate are employed as catalyst. The excess standard ferrous ammonium sulphate is then titrated with standard dichromate, using diphenylamine sulphate as the redox indicator. The method is accurate to within about 1 per cent. of the amount of chlorate present. It permits greater precision than the sodium arsenite-potassium bromate method. C.

**Dissolved Oxygen in Water: Determination.** I. M. Sillars and R. S. Silver. *J. Soc. Chem. Ind.*, 1944, 63, 177-179. Sources of error in the standard



Winkler method (addition of manganous chloride and potassium iodide to the acidified sample, and titration of the liberated iodine) are discussed and details are given of an improved technique (including electrometric titration), which reduces the sources of error and enables their effect at very low concentrations to be assessed statistically. Using this technique in a series of tests, the authors have found a standard deviation independent of the mean oxygen value of the sample of between 0.001 and 0.0025; i.e. the minimum oxygen content which can be significantly distinguished from zero is 0.004 c.c. of oxygen per litre. As some confirmation of the method, samples of known oxygen content were made by diluting oxygenated tap water in deaerated water, the residual oxygen content of which was obtained by a slight modification of the procedure. The measurements agreed with the known values to within the predicted accuracy, indicating that iodine was liberated in strict linear proportion to oxygen present at the concentrations used (0.01-0.14 c.c. per litre). C.

**Oxygen: Micro-determination.** M. Pollack, P. Pringsheim and Dolores Terwoord. *J. Chem. Phys.*, 1944, 12, 295-299. A method for the determination of small quantities of oxygen is based on measurements of the quenching of the phosphorescence of a dye adsorbed on silica gel. For measurements of the rate of oxygen production a current of purified nitrogen is passed through the system providing the oxygen and then through a tube containing the phosphorescent gel which is placed between the disks of a Becquerel phosphoroscope. The phosphorescent light passes into a photo-tube of the electron multiplier type and the amplified current is measured with a galvanometer. Details of the apparatus and procedure are given, and advantages and limitations of the method are pointed out. Results obtained in the measurement of oxygen production by algae and by electrolysis are shown graphically and discussed. C.

**Sulphate in Cellulose Esters: Determination.** C. L. Hoffpauir and J. D. Guthrie. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 391-392. A method for the determination of sulphate in cellulose nitrate is described which involves decomposition with nitric acid to which a small amount of perchloric acid is added after the initial stage of digestion. The sulphate in the digest is then determined by a method which depends on the fact that barium chromate dissolved in dilute hydrochloric acid reacts with sulphate ions to give a precipitate of barium sulphate and an equivalent amount of chromic acid which can be determined iodometrically after the excess barium chromate is precipitated by making the solution alkaline with ammonia. The method may also be used for the determination of sulphate in other esters of cellulose. Results obtained with various esters, with and without addition of known amounts of sulphuric acid, are given. C.

**Starch: Spectrophotometric Analysis.** R. W. Kerr and O. R. Trubell. *Paper Trade J.*, 1943, 117, *TAPPI*, 161-164. A method for the determination of amylose and amylopectin in starch is based on the fact that the former stains blue with iodine and the latter reddish-purple. The starch is stained under defined conditions and diluted to a 0.002 per cent. solution, the per cent. transmission of which is measured for wave-length 610 m $\mu$  at which amylopectin displays a minimum. This value is then located on a standard curve connecting transmission and composition of the mixture. The following values are recorded:

		Amylose.	Amylopectin.
Whole corn starch	... ..	25.5%	74.5%
Potato starch	... ..	25.5	74.5
Tapioca starch	... ..	20.0	80.0
Waxy maize starch	... ..	No amylose.	

The limitations of the method are discussed. C.

**Tannin: Determination in Water.** J. Haslam, J. S. Wilson and J. E. Edwards. *J. Soc. Chem. Ind.*, 1944, 63, 179-182. A modification of the Berk and Schroeder method for the determination of small amounts of tannin in hard water is based on the reducing action of the hydroxyphenyl group of the tannin substance on the Folin-Denis phosphotungstate and phosphomolybdate reagent. The reduction product, which is blue in alkaline solution, is determined colorimetrically. The precipitation of hardness salts is prevented by



the addition of sodium hexametaphosphate to the mixture of reagent and sample. Sulphides, ferrous salts and phenolic matter interfere seriously in the test, but sulphites, nitrites, ferric salts and silicates are almost without influence. Several samples of water used industrially contained comparatively large proportions of interfering phenolic matter. C.

**Esterified Pulp Fibres: Effects on Paper.** J. J. Harrison. *Paper Trade J.*, 1944, 119, *TAPPI*, 42-52. In extension of work by Bletzinger and Aiken on the effect of blocking the free hydroxyl groups of cellulose on its paper-making qualities, the author has investigated the acetates, butyrates and stearates of bleached Mitscherlich pulp. The esterifications are described and also the measurements of acyl content and degree of polymerization (D.P.). The stearates did not lend themselves to measurements of D.P. by the viscosity method for they were insoluble in organic solvents and in cuprammonium hydroxide, and the regenerated cellulose was also insoluble in cuprammonium. The original and the esterified pulps were beaten under standard conditions and made into sheets, and these were tested for (1) moisture regain, (2) hydro-expansivity (change of dimensions with humidity), and (3) strength. The results are fully recorded. They show that the hindrance to bonding (loss of strength) due to esterification increases and the hygroscopicity and hygro-expansivity decrease with the length of the ester chain, a low degree of substitution in the butyrates and stearates giving the same effect as a high degree of acetylation. The addition of acetone (which assists swelling) or benzene emulsion to the medium in beating helped to give better results with the acetates and butyrates but not with the stearates. C.

**Pulp-wood Holocellulose: Chain-length Distribution; Effect of Cooking and Bleaching.** J. E. Atchison. *Paper Trade J.*, 1943, 116, *TAPPI*, 243-254. Details are given of an investigation of the effects of cooking and bleaching on the chain-length distribution in the holocellulose of spruce-wood. It is shown that this carbohydrate fraction suffers very little degradation during isolation by a modification of the method of Van Beckum and Ritter (1937; alternate chlorination and extraction of the chlorinated lignin by a 3 per cent. solution of ethanalamine in 95 per cent. alcohol). The holocellulose and the pulps prepared from the same wood by the sulphite, soda, and sulphate processes were nitrated by means of a nitric-phosphoric acid mixture and the average chain lengths of the nitrates were calculated from viscosity data (acetone solutions) by Staudinger's rule. The nitrates were also fractionated and the degrees of polymerization (D.P.) measured on the fractions and insoluble residues. The holocellulose as it exists in the wood has an average D.P. of 1450, but is a heterogeneous mixture of products with either very low or very high D.P. On pulping the very short molecules disappear and there is some degradation of long molecules so that there is a net increase in the proportion of medium-length chains. This effect is more marked in sulphate pulping than in the soda or sulphite processes. Bleaching still further enhances the molecular heterogeneity. The use of sodium chlorite as agent for the isolation of the holocellulose was also examined, but there is evidence that the product suffered extensive degradation. C.

**High Polymers: Molecular Weight.** H. W. Melville. *Trans. Faraday Soc.*, 1944, 40, 217-220. The determination of the molecular weight of high polymers is discussed and some of the difficulties attending measurements by end group, osmotic, ultracentrifugal and viscosity methods are outlined. The fractionation of polymers and the importance of measurements of molecular weight distribution are briefly discussed. C.

**Foam-inhibiting Agents: Activity.** S. Ross and J. W. McBain. *Ind. Eng. Chem.*, 1944, 36, 570-573. Tests were made with the following foaming systems: 7.74 per cent. Aerosol OT in triethanolamine, 5.55 per cent. Aerosol OT in diethylene glycol, 34.0 per cent. triethanolamine oleate in triethanolamine, 1.55 per cent. Nacconol NR in water and 0.85 per cent. Aerosol OT in water. The foam inhibiting effects of 22 chemical agents when added in the proportion of 1 per cent. by volume of the original solution were determined. It was found that systems which have a chemical similarity in either solute or solvent, when compared with respect to the anti-foaming effect of the same additions, show a corresponding effect in three out of every four cases; when systems have a more complete chemical resemblance, the correspondence of

the effects is even greater. Complete correspondence is shown, for example between Aerosol OT in triethanolamine and Aerosol OT in diethylene glycol. Only four of the additives tried, namely ethyl oleyl glycol *o*-phosphate, tri-octyl tripolyglycol tetrapolyphosphate, ethyl phosphate and *n*-nonyl alcohol, were effective foam inhibitors for all five foaming systems. Some experiments on the effect of concentration indicated that in general an optimum concentration seems to exist for defoaming action, which optimum sometimes lies definitely above the solubility of the agent. The most pronounced foam inhibitors are preponderantly insoluble. The action of foam inhibitors in the bulk tests is compared with their action on single films of the foaming systems, and the spreading of additives on single films is discussed from the point of view of surface tensions. It is pointed out that more than one mechanism must be postulated to account fully for all types of foam inhibition by chemical agents. C.

**Co-polymerides: Chain Reactions.** R. Simha and H. Branson. *J. Chem. Phys.*, 1944, 12, 253-267. The kinetics of chain copolymerizations are developed for reactions consisting of (1) an activation of stable monomeride; (2) a growth of activated polymer radical by monomeride addition; (3) a stabilization of the growing chains by (a) monomeride addition, (b) growing polymeride. The existence of a steady state in respect to the concentration of growing chains beyond the induction period is assumed. The rate constants of growth and termination will in general depend upon the individual composition and upon the nature of the activated chain end. Equations for the rate of change of mole ratio of the two monomeride species are developed in terms of mean rates of growth and termination obtained by averaging the actual rates over the distribution of growing polymeride. The equilibrium conditions lead to a set of difference equations for this distribution. The authors have examined the solution and results derived therefrom to see if they are of a form which permits a determination of the dependence of the rate constants for growth and termination upon the composition of the polymeride molecule. The influence of the type of active chain end involved on over-all rate and size distribution is considered. Various special cases are presented. Experimentally it is difficult to distinguish on the basis of kinetic data between the foregoing mechanism and one in which the rates of growth (and termination) for each of two kinds of monomeride depend solely upon the nature of the monomeride molecule added and are independent of the nature of the active chain end. Relations are derived for the molecular size distribution, the inhomogeneity of the copolymeride mixture in regard to composition, the average molecular weight, and the average composition of copolymeride as function of the composition of the monomeride residue. The importance of these results for soluble and insoluble copolymerides and for the theory of gel formation in vinyl-divinyl type polymerides is pointed out. C.

**Starch Hydrolyzates: Moisture Sorption.** J. E. Cleland and W. R. Fetzer. *Ind. Eng. Chem.*, 1944, 36, 552-555. Moisture equilibrium data have been determined in absorption and desorption for corn syrups and sugars by a method in which the sample was dispersed on diatomaceous silica and then exposed in a desiccator to air at various controlled humidities. The humidity of the air was controlled by passing it first through a bottle containing a saturated solution of a salt providing the desired humidity and then through bottles of sulphuric acid of such density as to yield air of relative humidity corresponding to that of the first bottle. Results are given in tables and graphs and briefly discussed. The amount of absorbed water is found to increase with dextrose equivalent and with increasing relative humidity. The data are compared with similar data for invert syrup and glycerol. C.

**Cellulose Acetates and Polymethylmethacrylates: Osmotic Pressure.** E. A. W. Hoff. *Trans. Faraday Soc.*, 1944, 40, 233-236. Osmotic measurements on cellulose acetates and polymethylmethacrylates in chloroform are recorded in the form of plots of  $\Pi/c$  against (1)  $c$  and (2)  $\Pi$ . Plots (1) are not rectilinear and (2) are rectilinear only for some of the cellulose acetates. In most cases, however, both kinds of plots can be extrapolated graphically to the same value of  $(\Pi/c)_0$  for the same substance. Plots of  $\Pi/c - (\Pi/c)_0$  are also given. C.

**High Polymers: Molecular Weight Measurements; Interpretation.** G. Gee. *Trans. Faraday Soc.*, 1944, 40, 261-266. A study of the theoretical basis of

the osmotic pressure relation  $(\Pi/C)_0 = RT/M$  shows that if  $(\Pi/C)_0$  can be found accurately, the absolute molecular weight of a polymer, as dispersed in the solvent which has been employed, may be calculated with complete confidence. Much the simplest and most widely used method of obtaining the molecular weight of long-chain polymers depends on the measurement of the viscosity of a dilute solution. Various attempts to calculate the viscosity of polymer solutions have led to equations of the general form  $[\eta] = KM^\beta$ . For essentially linear and approximately homogeneous polymers it appears that viscosity measurements can be used to measure molecular weights, once values of  $K$  and  $\beta$  have been found by calibration against the osmotic method. For linear polymers which are not homogeneous the viscosity method gives an average molecular weight for the mixture, which average, however, is not the same as that given by the osmotic method. When both osmotic and viscosity molecular weights have been determined, a comparison of the two gives a rough idea of the homogeneity of the sample. The viscosity method becomes of much less value when there is a possibility of the polymer being non-linear in structure. No reliable conclusions about molecular weight distribution can be drawn from molecular weight data alone, without carrying out a fractionation.

C.

**Crystalline Polymers: Melting.** Elizabeth M. Frith and R. F. Tuckett. *Trans. Faraday Soc.*, 1944, 40, 251-260. The thermodynamic equilibrium between crystalline and amorphous polymeric phases is discussed in terms of a fringed micelle model, as indicated by X-ray data. An expression derived for the melting point of a crystalline polymer is found to depend on the proportion  $\theta$  of amorphous material in the structure: this unsharp melting-point depends ultimately on a non-linear relationship between  $\theta$  and the free energy of the system. Calculated values of the crystalline-amorphous equilibrium ratio over a range of temperature are in good agreement with experimental data. An attempt is made to extend the calculations to the case of stretched polymers and a qualitative agreement is found.

C.

**Cellulose: Degree of Polymerisation.** O. A. Battista. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 351-354. Viscosity-concentration data are given for five samples of purified cellulose (viscose rayon, two rayon wood pulps, absorbent cotton and raw cotton), representing the degree of polymerisation range 300 to 3,000. On plotting the data on semilogarithmic paper, linear relationships were found in each case, between (1) the viscosity function  $\eta_{sp}/c$  and concentration, and (2) the relative viscosity function  $(\eta_r + 1)$  measured at 0.5 per cent. concentration and the degrees of polymerisation corresponding to values calculated from viscosity-concentration data extrapolated to infinite dilution. The data have been used to derive a mathematical expression by means of which the value of the relative viscosity function at the standard concentration of 0.5 per cent. may be converted to degree of polymerisation data equivalent to values obtained by extrapolation of viscosity-concentration data to infinite dilution.

C.

## 10—ECONOMICS

**Japanese Cotton Industry: Development.** *Textile Recorder*, 1944, 61, July, 40-41, 57. The writer discusses the present position and future ambitions of the Japanese cotton industry and quotes recent statistics of wages and production. In 1936 average wages for all male factory workers were 33.8 pence and for females 10.3 pence, per day of 9½ hours, and in the cotton industry about four-fifths of the operatives were females, with a large proportion under 16 years of age. Three firms handled 80 per cent. of the raw cotton.

C.

**Liverpool Cotton Association: Functions.** *Textile Recorder*, 1944, 61, March, 34-37. A brief account of the history of the Liverpool Cotton Association Ltd. and of operations on the Cotton Exchange, with special emphasis on their service to the cotton industry.

C.

**Plastics Raw Materials: Potential Supplies.** W. D. Scott. *Chemistry and Industry*, 1944, 274-278. The author raises the question whether the development of the plastics industry can be adequately supported by the chemical industry and concludes that a properly organized chemical industry can support a plastics industry many times greater than at present. The argument is based on the following tables of statistics: (1) Ratio of costs of the raw materials

of the plastics industry in the United Kingdom to those in the United States of America; (2) Ratio of labour, power, steam, coal and gas costs, U.K./U.S.A., (3) Costs of benzole recovery; (4) Output of olefines and aromatic hydrocarbons from a tubular steam cracking unit processing 600,000 tons of heavy naphtha per annum; (5) Coal utilization in Great Britain; (6) Comparison of methods for producing motor spirit; (7) Yields of chemical products from coal, at coke ovens and gas works and in the U.S.A.; (8) Yields of the various phenols on the basis of 65,000 tons of tar acids per annum; (9) Yields of tar acids and bases by the "hydrogenolysis" of Pittsburgh seam coal; (10) The potential production of alcohol, furfuraldehyde, cellulose, lignin, and vanillin from a recurrent supply of 200 million tons of waste cellulosic material, with figures for the production and industrial consumption of alcohol in the U.S.A. C.

**Textiles and Clothing: Production in S.E. Europe.** "*Planning*," 1944, No. 223, pages 3-16. This broadsheet raises the question of the restoration of the States of S.E. Europe and provides data on their economic development, under the headings (1) nutrition, (2) agriculture, (3) industrial development, (4) transport, (5) marketing and (6) finance. Under (3) figures are given for (a) the consumption of cotton goods, in kilos., per head of population, 1937, and (b) the percentage of people employed in the manufacturing industries whose work is in textiles and clothing: Yugoslavia (a) 2.0, Bulgaria (a) 2.8, Roumania (a) 2.2, (b) 26.1, Greece (a) 2.9, Poland (a) 2.3, (b) 25.5, Hungary (a) 2.4, (b) 24.5, Czechoslovakia (a) 4.2, (b) 22.5, Austria (a) 5.1, (b) 10.7. C.

**Textile Costing System.** H. M. Broadley. *J. Textile Inst.*, 1944, 35, P73-82. C.

**Textile Operatives' Earnings, 1944.** *Textile Weekly*, 1944, 34, 395. Wages at the end of January, 1944, are tabulated for various age groups and sections of the textile industry, and compared with wages in October, 1938. There has been an average increase in wages of 72 per cent. and working hours have risen from 45.8 to 47.3. C.

**Textile Wholesale Prices, July and August, 1944.** *Bd. Trade J.*, 1944, 150, 305, 341. The Index numbers for July and August are Cotton 159.3, 159.3, Wool 184.0, 184.0, Other textiles 133.7, 133.6, All articles 167.1, 167.5, (1930=100). C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

**Operatives: Aptitude Testing.** *American Machinist*, 1944, 88, No. 16, 91-94. A brief illustrated account is given of methods for testing operatives engaged on assembling spark-plugs and selecting them for promotion to special duties. The tests are based on preliminary "job analyses" and observations on operatives of proved ability. C.

**Scientific and Industrial Research: Organisation.** *Nature*, 1944, 154, 249-252, 283-287, 311-314, 345-348, 373-377, 407-411. A critical review of recent discussions in England and the United States, including "A Post-war Policy for Science," by the Association of Scientific Workers; "Problems of Scientific and Industrial Research," from Nuffield College; the Symposium, "Organisation, Direction and Support of Research," by the American Philosophical Society; the "Goodenough" Report on Medical Schools; "A Scientific Policy for Agriculture," by the Parliamentary and Scientific Committee; various reports on Education, including Sir Ernest Simon's pamphlet on the Development of British Universities and the report of the British Association Committee on Post-war University Education; addresses by Lord McGowan and Mr. S. Courtauld; "Government and Industry: A Framework for the Future," by a Fabian research group; and Dr. D. W. Hill's "Impact and Value of Science." C.

**Textile Processing Research: Organisation.** American Association of Textile Chemists and Colorists. *Amer. Dyes. Rept.*, 1944, 33, 82-84. Recommendations are put forward for the reorganisation of the research activities of the Association. They include (1) a budget of about \$35,000 a year for the next five years, (2) the appointment of a permanent Director of Research, (3) more frequent publication of progress reports, and (4) establishment of research headquarters at the Lowell Textile Institute. C.

# THE JOURNAL OF THE TEXTILE INSTITUTE

## ABSTRACTS

### 1—FIBRES AND THEIR PRODUCTION

#### (B)—ANIMAL

**Merino Sheep: Control of Blowfly.** A. H. de Vries and J. C. de Klerk. *Fmg. in S. Africa*, 1944, 19, 485-495. Reference is made to previous articles on blowfly control (these *Abs.*, 1943, A555 and A675). The Australian classification of sheep into A, B and C types is described, A type having no folds, B type either medial or lateral folds, and C type prominent medial and lateral folds and other undesirable characters and being most susceptible to blowfly strike. Skin development on the tail is most undesirable, and Australian experiments have proved that skin development in the breech can be eliminated by breeding. Data are given on the availability of A type rams in S. Africa, and a breeding policy recommended. W.

**Sheep Blowfly Research. VII. Investigations in the Cape Winter Rainfall Area.** H. O. Mönnig and P. A. Cilliers. *Onderstepoort J.*, 1944, 19, 71-77. The investigation comprised the measurement of rainfall, temperature and humidity, the collection and identification of maggots from struck sheep and from the carcasses of sheep and various small animals, and trapping by means of ordinary meat bait. The live sheep produced mainly *Lucilia cuprina*, and the carcasses various species of *Chrysomyia*. W.

**Research as Applied to Animal Production.** R. B. Kelley. *Australian Vet. J.*, 1944, 20, 236-238. Research into domestic animal production in Australia should (1) determine characteristics and the range of genetic variability, (2) define and classify climate as the outstanding condition of the primary environment, (3) state the conditions of secondary or economic environments, and (4) co-ordinate the results by assessing the costs of production. Although major contributions have been made as broad surveys of the primary environment, no well-conceived attempt has been made to analyse existing data, e.g. to determine the suitability of particular breeds or strains of merino sheep for tropical environments. W.

**Research as Applied to Animal Production.** L. B. Bull. *Australian Vet. J.*, 1944, 20, 233-235. A discussion of the scope of ecology, physiology (functional and structural), nutrition and dietetics, and genetics and breeding as applied to the improvement of the healthy animal and its product. W.

**U.S.A.: Sheep and Wool Research.** W. R. Lang. *Pastoral Rev.*, 1944, 54, 262-263. The activities are listed of the Bureau of Animal Industry of the United States Department of Agriculture, especially those of the Western Sheep Breeding Laboratory, Dubois, Idaho, and the Southwestern Range and Sheep Breeding Laboratory, Fort Wingate, New Mexico. The latter deals with Navajo sheep. W.

#### (C)—VEGETABLE

**Cotton Plant: Variety Experiments in Georgia.** R. P. Bledsoe and E. D. Matthews. *Georgia Sta. Circ.* 140, 1943, 8 pp. (through *Exp. Sta. Rec.*, 1943, 89, 59). Coker 100, Stoneville 2B, and D. and P.L. were high in money value and lint yield per acre in north Georgia tests, 1938-42. Results were similar in 1940 and 1942, except that Coker 200 also yielded high. Three strains of Empire, a new variety developed by the station and U.S. Department of Agriculture, cooperating, were noteworthy in 1942 tests. Empire is of the Stoneville type, but has larger bolls, and higher lint percentage, and is early. Its lint length approximates to that of the above three leading varieties. In south Georgia tests, 1938-42, leaders in acre value included Coker 4-in-1, Coker Cleveland 7, and W. W. Wannamaker Cleveland Wilcox Resistant. Average results in

1942 resembled those of previous tests, except that Coker Cleve-wilt 7 yielded relatively lower than heretofore. The most promising new strains tested in 1942 were Wannamaker Stonewilt 18 and Bobshaw 1. C.

**Cotton Plant: Variety Trials.** R. S. Hawkins. *52nd Ann. Rept. Arizona Agric. Exp. Sta. for year ending June 30, 1941, 1942*, 99 pp. (through *Plant Breed. Abstr.*, 1944, 14, 195). Variety trials in 1940 showed that the varieties Delta and Pineland 44-51 out-yielded all others when grown in Upland regions, whilst Coker-Wilds 11 produced the longest fibre but the lowest yields. S × P yielded more heavily than the two other American-Egyptian varieties, P—S × P (Earlipima) and Pima. Some 1,300 F<sub>2</sub> plants of the Pima—120 cross and 60 plants of the F<sub>1</sub> back-cross (F<sub>1</sub> Pima × 120) × Pima, were grown with a view to selecting for a combination of fine linting, ability of the boll to hold the seed cotton, and productiveness. Crosses were made between the *G. barbadense* and Upland cotton hybrids on the one hand and Hopi × Stoneville hybrids on the other, in an attempt to combine the disease resistance of the *G. barbadense* type with the good quality of the other forms. Strength tests on the Stoneville cotton grown on the Yuma Farm show it to be stronger than any other cotton tested. The F<sub>6</sub> of the Stoneville × Hartsville cross was grown, and selfed seed obtained from those lines which showed promise. The progeny of crosses between Santan and many other varieties have been tested with a view to selecting a type possessing better lint and spinning quality than that variety. C.

**Manchurian Cotton: Improvement.** S. Nakatomi. *Plant Breed. News*, 1934, 9, 547-548 (through *Plant Breed. Abstr.*, 1944, 14, 227). Three selected strains obtained from a cross between a Manchurian cotton and a variety from southern China are illustrated in the original paper. They mature early like the native cotton which they surpass in ginning percentage and staple length. C.

**Station Miller Cotton: Characteristics.** H. B. Brown. *Louisiana Sta. Circ.* 29, 1943, 7 pp. (through *Exp. Sta. Rec.*, 1943, 89, 206). The strain of Station Miller cotton currently grown, according to test results, is a relatively good producer, has a medium large boll (60-65 per pound of seed cotton), is a good picking cotton with staple length 31-33 thirty-seconds of an inch, lint percentage 34-37, and considerable wilt tolerance, and the seed has a high oil content. It is considered desirable for hill lands in north Louisiana. C.

**Upland Cotton Kannô No. 1: Production and Characteristics.** S. Nakatomi. *Plant Breed. News*, 1934, 9, 544-547 (through *Plant Breed. Abstr.*, 1944, 14, 226). By line selection of an early maturing upland cotton, King's Improved, at Kantô-syu Agricultural Experiment Station, the new line, Upland Cotton Kannô No. 1, was obtained. It matures much earlier and is more productive than the parent type. It was thought most promising for southern Manchuria. C.

**Cotton Crop: Reduction of Labour and Power Requirements.** H. P. Smith. *Agric. Eng.*, 1943, 24, 149-150 (through *Exp. Sta. Rec.*, 1943, 89, 488). The principal means whereby the power and labour requirements of the cotton crop may be lowered are (1) the use of larger units and the performance of two or more operations at the same time; (2) mechanical thinning, hill dropping of mechanically delinted seed, and planting thin; (3) the treating of seed to obtain better stands, (4) shallow cultivation; and (5) the use of mechanical harvesting equipment. A suitable mechanical harvester in the plains areas would reduce almost by one half the total labour to produce a crop. In these areas a simple, cheap, stripper-type machine can be used satisfactorily. In sections where the plants grow larger and the harvest is earlier, a picker-type machine would probably be more suitable. C.

**Cotton Fields: Row Widths and Yields.** D. M. Simpson and E. N. Duncan. *J. Amer. Soc. Agron.*, 1942, 34, 544-552 (through *Exp. Sta. Rec.*, 1943, 88, 760). Review of row width experiments with cotton at several stations indicated that narrow rows yield more per acre, whilst wider rows yield more per row. Since planting and cultivating operations are done by the row, the number of feet of row per acre is important in determining production costs. Row widths may be varied from 2.5 to 4.5 ft. without materially changing cost of cultivation per row, and, in general, should be adjusted so as to result in the lowest cost per pound of cotton produced or the greatest production return for labour and equipment. In experiments at Knoxville, Tennessee,

1938-40, yields of cotton per row increased consistently and profitably as row widths were widened from 2.5 to 4.5 ft. Optimum row widths may depend upon local conditions regarding land value, labour and equipment costs. C.

**Cotton Plant: Effects of Ploughing and Seed Treatment on Sand.** H. P. Smith and M. H. Byrom. *Texas Sta. Bul.* 621, 1942, 16 pp. (through *Exp. Sta. Rec.*, 1943, 89, 257). On Lufkin fine sandy loam, a soil which tends to pack and crust after rains, better stands of cotton were obtained when the furrow for the seed was opened with a knife or runner-type furrow opener than when opened with either a narrow or wide shovel opener. It appeared that the knife opener gave better results, because it left a clean furrow and a firm seed bed with little loose soil. It did not disturb the soil enough to cause it to dry out as rapidly as when the furrows were made by shovel openers. A narrow shovel  $1\frac{1}{2}$  in. wide, with shields to hold the loose soil out of the furrow until the seed reached the bottom of the furrow, gave better results than a shovel 4 in. in width. The regular open centre press wheel used after covering the seed and in combination with a knife opener gave a slightly higher percentage of emergence than did other types of press wheels. Rolling on the seeds and pressing them in the bottom of the furrow before covering did not give any better stands than when the soil was pressed with an open centre press wheel after covering. All types of press wheels gave slightly better stands of cotton on the Lufkin fine sandy loam than those obtained when no press wheel was used. Cottonseed planted at a constant depth gave better stands and yields on the Lufkin fine sandy loam than did cottonseed planted at variable depths. Treatment of cottonseed with Ceresan was followed by significant increases in the emergence of cotton seedlings. Lime reduced emergence to some extent, while sulphur apparently had no effect on germination and emergence. C.

**Cotton Plant: Nutrient Uptake.** L. C. Olson and R. P. Bledsoe. *Georgia Sta. Bul.* No. 222, 1942, 16 pp. (through *Exp. Sta. Rec.*, 1943, 88, 760). The time and rate of absorption of plant foods by cotton were studied, 1939-40, under field conditions on three soils that are acid and low in base-exchange capacities, organic matter and mineral nutrients. At 120 days or longer after planting dry weight production and nutrient absorption was largely confined to the bolls. Some translocation of nutrients from plants to bolls occurred at the late growth stages. The amount of nutrients found in the cotton plant exceeded that ordinarily added in fertilizer mixtures, indicating the importance of plant residues in maintaining the fertility of cotton soils. The average amounts of nutrients found in the mature plants for all three soils approximated to N 104 lb.,  $P_2O_5$  38,  $K_2O$  97, CaO 132, and MgO 43 lb. C.

**Cotton Plant: Potash Requirement Test.** L. C. Olson. *Proc. Soil Sci. Soc. Amer.*, 1941, 6, 238-242 (through *Exp. Sta. Rec.*, 1943, 89, 180). Laboratory studies were carried on of soil reaction, clay content, available K, base-exchange capacity, and exchangeable bases. The available K in the soil prior to application of fertilizer was found to give a reliable index of the needs of the cotton plant for potash. The response from liming for cotton was found to be related to the amount of available potash in the soil. C.

**Cotton Plant: Response to Potash.** J. G. Futral and J. J. Skinner. *Georgia Sta. Bul.* No. 223, 1942, 15 pp. (through *Exp. Sta. Rec.*, 1943, 88, 739). Seven soil types were included in a comparative study of fertilizers that do or do not develop acidity, the latter having been neutralised with dolomitic limestone. The results indicate that neutralizing acid-forming fertilizers with dolomitic limestone does not materially affect the response or requirement for potash of the cotton plant. C.

**Cotton Soils: Effect of Sulphur Deficiency on Production.** O. R. Younge. *Proc. Soil Sci. Soc. Amer.* 1941, 6, 215-218 (through *Exp. Sta. Rec.*, 1943, 89, 184). Fertilizer treatments with sulphur and its effect on cotton production are reported for 10 soil types in the Coastal Plain of S.W. Arkansas. Six showed significant yield reduction where sulphur was not applied as compared with applications of 12 lb. of sulphur per unit of 4-10-4 fertilizer. Sulphur deficiency caused a marked reduction in the number of bolls produced, but boll size was not appreciably affected. Insufficient sulphur delayed growth, as indicated by the lower percentage of the yield being ready for harvest at the first picking. Sulphur deficiency had little effect on staple length, size of bolls, and lint turn-out. Yields of seed cotton and seed varied directly with the associated lint yield. C.



**Cotton Plants: Wilt and Root-knot Resistance and Effect of Potash Fertilizer.** *Bull. Texas Exp. Sta.* 627, 1943, 26 pp. (through *Rev. Appl. Mycol.*, 1944, 23, 225). In the sandy-loam fields of East Texas cotton yields are often seriously decreased by wilt (*Fusarium vasinfectum*), nematode root knot (*Heterodera marioni*), and potash hunger. Results of variety-fertilizer tests are reported. The data show that the use of a potash fertilizer increased yield and reduced wilt. Tests over a period of six years showed that the following varieties (arranged in decreasing order of likely value) were highly wilt-resistant: Coker 4-in-1, Coker 100 Wilt Resistant str. 39-5, Delta Dixie W.R. str. 2, Tifton Dixie Triumph, Dixie Triumph 25-12, Dixie 14-5 str. 2, Delfos 425, Miller 610, Delta-pine 12, and Stone-wilt. In addition, Coker 4-in-1, Coker 100 W.R. str. 39-5, and three strains of Dixie varieties were resistant to wilt and root knot together. Miller 610 lost much of its wilt resistance in the presence of root knot. It is concluded that farmers can prevent wilt and root knot from becoming limiting factors in cotton production by growing only those varieties that are resistant to both, using high-potash balanced fertilizers, and rotating cotton with *Crotalaria spectabilis* and sorghum. C.

**Cotton Root Rot Organism: Control by Sulphur.** A. A. Dunlap. *Phytopathology*, 1943, 33, 1205-1208 (through *Rev. Appl. Mycol.*, 1944, 23, 224-225). When thoroughly mixed with the soil and autoclaved, 325-mesh dusting sulphur, at the rate of one part per 1,000 of air-dry black Houston clay soil, totally inhibited the formation of sclerotia by the agent of cotton root rot, *Phymatotrichum omnivorum*, with no apparent effect on mycelial growth. At 1:2,000 the same mixture permitted only a trace of sclerotial growth, which proceeded unchecked, however, in the presence of a 1:8,000 concentration. The repressive action of the sulphur-soil mixture is possibly due to the formation of a toxic compound on autoclaving. C.

**Cotton Seedling Disease: Occurrence in West China.** L. Ling and J. Y. Yang. *Ann. Botany*, 1944, 8, 91-104. A species of *Colletotrichum* which differs from the conidial stage of *Glomerella gossypii* in morphological characters was noticed on diseased cotyledons and bolls of cotton in Szechuan Province, West China. It was considered to be identical with *C. indicum* Dast. Morphological and cultural characteristics are described and the results of investigations of the influence of temperature and pH on germination and growth are reported. The conidia are susceptible to desiccation. The production of toxic substances capable of causing blight of cotton seedlings was not confirmed. Artificial infection was successful on both Chinese varieties of *Gossypium arboreum* and American varieties of *G. hirsutum*. Soaking of seeds in conidial suspensions of the fungus resulted in a high percentage of diseased seedlings. Lesions on the cotyledons, young stems, young leaves, and detached bolls were induced by spraying with the conidial suspension. Besides cotton, fruits of pepper, tomato, eggplant, and pods of soybean and cowpea were successfully infected, but no plant included in the tests was found susceptible at the seedling stage. The fungus over-winters chiefly inside the infected seeds and possibly in the affected host tissues left in the field. Fairly high temperature in combination with high humidity favours the development of the disease, the latter factor being even more important under the conditions of cotton-growing regions of Szechuan. A rainy or cloudy period not only facilitates the dissemination of conidia, but also prevents the mucilaginous matrix from drying out; hence the conidia may survive for a longer period. C.

**Cotton Seedling Diseases and Boll Rots: Distribution and Dissemination.** U.S. Dept. Agric., Bur. Plant Ind., Soils, and Agric. Eng., *Plant Disease Rptr.*, 1943, Sup. 141, 53-78 (through *Exp. Sta. Rec.*, 1943, 89, 454). The following reports summarise the results of four years of surveys for cotton diseases and of special studies on distribution and dissemination suggested by observations made during the surveys: Occurrence of the Anthracnose Fungus, *Glomerella gossypii*, on Cotton Plants Grown from Infested Seed at Four Locations in 1941, by R. Weindling (pp. 59-65); Relation of Ginning to Contamination of Cotton Seed by the Anthracnose Fungus, by R. Weindling and P. R. Miller (pp. 65-72); and A Summary of Four Years of Cotton Seedling and Boll Rot Disease Surveys (pp. 54-58), The Dissemination of Fungus Spores from Contaminated Seed Cotton During Ginning in Relation to the Germination of the Seed and the Diseases of the Seedling (pp. 72-75), and The Probable



Effect of Humidity on the Survival and Sporulation of the Anthracnose Fungus on Cotton (pp. 76-78), all by P. R. Miller. C.

**Cotton Virus Disease: Occurrence and Control.** S. N. Moskovets. *Trans. Conference on Plant Virus Diseases, Moscow, 1940*, 173-190 (through *Rev. Appl. Mycol.*, 1944, 23, 213-214). Differences between the virus disease of cotton in Azerbaijan and the leaf curl occurring in the Sudan are pointed out. To avoid confusion of the two diseases it is proposed to name that in Azerbaijan "cotton curliness." Observations of reductions in the number of bolls caused by the disease and the susceptibility of different varieties are recorded. It is estimated that in years of severe infection susceptible varieties may suffer losses in yield up to 9.5 per cent. The disease also affects the quality of the fibre, reducing its length by about 7.5 per cent. and lessening its absolute strength by 3.3-16 per cent. The virus from cotton was successfully transmitted by *Aphis gossypii* or by infusing infected sap into decapitated stems of healthy plants to *Gossypium barbadense* and its variety *maritima*, and to *G. hirsutum*; similar symptoms were produced on *Hibiscus cannabinus* and *Solanum dulcamara*. Experimental data showed that under local conditions *A. gossypii* is the most important vector, *A. laburni*, *Myzus persicae*, and *Epitetranychus althæae* playing a secondary part. The incubation period of the virus varied from 35 to 56 days. The results of field tests with isolation from insects pointed to the possibility of seed transmissions. Less disease appeared to occur in denser stands. Higher incidence in summer- than in spring-sown plants was at least partly due to higher temperatures of soil and air. Some cottons were resistant to the virus; the most promising among those bred in Azerbaijan are strains of *G. barbadense*, such as Giza 7 and 3782-1 (from Giza 12), and *G. maritima*, such as Nos. 1, 2 and 7, and among those bred in Russian Central Asia, 6081, No. 15, 263, 4623a, and 35-1. For the control of cotton curliness the author suggests the growing of resistant varieties, roguing of infected plants, separate harvesting from healthy and diseased plants to ensure healthy seed for the next year, and control of vectors. C.

**Cotton Virus Disease: Effects.** V. L. Ryjkoff and Mme. T. P. Ovcharova. *Trans. Conference on Plant Virus Diseases, Moscow, 1940*, 191-196 (through *Rev. Appl. Mycol.*, 1944, 23, 214-215). The anatomical changes produced by the virus disease of cotton found in Azerbaijan consist in a thickening of the leaf lamina, the presence of excessive starch in the lamina and petioles, underdeveloped bast fibres in the petioles, and underdeveloped roots which are poor in starch. The disease is considered to be a special type of yellows, although it lacks the hypertrophy and necrosis of the phloem usual in this group of virus diseases, and produces an unusual hypoplasia of the bast fibres. It differs from the leaf curl disease of cotton in the Sudan in the following points: in Azerbaijan the diseased leaves tend to curl upwards, the palisade parenchyma is more strongly developed than in healthy plants, no additional cylinders are formed in the stems and petioles, and the bast fibres are hypoplastic; in the Sudan the diseased leaves mostly curl downwards, the palisade parenchyma is either underdeveloped or not developed at all, and additional cylinders are formed in stems and petioles. It is suggested that the two diseases are distinct, and it is proposed to name that in Azerbaijan "leaf roll" and the virus causing it, according to K. M. Smith's classification, *Gossypium virus 2*, Verderevsky. C.

**Cotton Virus Disease: Effects.** L. K. Kara-Murza. *Trans. Conference on Plant Virus Disease, Moscow, 1940*, 197-202 (through *Rev. Appl. Mycol.*, 1944, 23, 215). In a physiological study of the Azerbaijan virus disease of cotton it was found that the leaves of diseased plants contain less total and albuminous nitrogen and both leaves and petioles have more carbohydrates, particularly starch, than those of healthy plants, the amount of carbohydrates in the reproductive organs and in the stem walls being, on the other hand, smaller; furthermore, the accumulation of dry matter is less intense, and the amount of chlorophyll smaller. C.

**Boll Weevil: Winter Survival.** R. C. Gaines. *J. Econ. Ent.*, 1943, 36, 82-84 (through *Exp. Sta. Rec.*, 1943, 89, 345). It was found in a limited number of records that the number of boll weevils in woods trash was associated with the number of boll weevils present in cotton fields during the following May and June. Since the correlations between winter temperatures and the

number of weevils in cotton fields during May and June were significant, the inference would be that ground trash affords an important shelter for the weevils during the winter. C.

**Calcium Arsenate Insecticides: Effect of Particle Size.** J. C. Gaines and H. A. Dean. *J. Econ. Entomology*, 1943, 36, 76-79 (through *Exp. Sta. Rec.*, 1943, 89, 339). A report is given of tests of a calcium arsenate preparation containing large particles, a calcium arsenate-sulphur-rotenone mixture, and commercial calcium arsenate against the boll weevil, bollworm, and aphids at College Station, Texas, and against the boll weevil and aphids at Tallulah, La. The special and the commercial calcium arsenates were equally effective against weevils at both locations, but the coarse material (special calcium arsenate) did not give as good control of bollworms at College Station as the commercial product. Both materials contained approximately the same percentage of water-soluble arsenic pentoxide. The special calcium arsenate-sulphur-rotenone mixture significantly controlled the aphids and increased the yield at Tallulah, whilst the aphids did not injure the cotton sufficiently at College Station for the mixture to increase the yields. C.

**Cotton Aphids, Bollworms and Weevils: Control.** J. C. Gaines. *J. Econ. Entomology*, 1943, 36, 79-81 (through *Exp. Sta. Rec.*, 1943, 89, 339). The yields indicated that calcium arsenate-rotenone and calcium-zinc arsenate mixtures were equally effective and better than calcium arsenate alone. The higher yields were due to aphid control in the first case and slightly better bollworm control as well as retarding aphid increases at least two weeks in the latter. In a second experiment alternate applications of calcium arsenate and lead arsenate, using two applications of lead arsenate during the peak of bollworm injury, gave good control of both weevils and bollworms. Losses in yields occurred when cryolite was used in this manner, because of the increased weevil injury. Two consecutive applications of either lead arsenate or cryolite at the peak of bollworm injury instead of calcium arsenate did not prove to be effective against weevils, thus causing a loss in yield. C.

**Cotton Seed: Delinting and Disinfection.** U. R. Gore. *Georgia Sta. Circ.* 141, 1943, 18 pp. (through *Exp. Sta. Rec.*, 1943, 89, 80). Anthracnose-infested seed averaged an increase of 159 lb. of seed cotton to the acre from Ceresan treatment. Machine delinting or reginning gave an increase of 167 lb. and reginning plus the chemical treatment an average increase of 250 lb. of seed cotton to the acre over the fuzzy, untreated seed. Planting of about 1 bushel of reginned seed per acre is recommended. Either New Improved Ceresan or Ceresan proved effective dusts for cotton seed, which may be treated at any convenient time and stored in a dry place until planted. It is a good insurance any season to treat with organic mercury dusts. Being poisonous, treated seed should not be fed to stock or sold for oil. Seed heated in storage or damaged seed of low vitality should not be planted. Ample planting seed should be saved, since 2-year-old seed is almost free from disease and seed will be available should replanting be necessary. C.

**Cotton Seed: Gin Delinting and Incidence of Disease.** S. G. Lehman. *Research and Farming [North Carolina Sta.]*, 1943, 1, *Prog. Rept.* 2, pp 5, 6 (through *Exp. Sta. Rec.*, 1943, 89, 454-455). Reginning to remove the linters has been found to carry off much of the load of fungus spores and bacteria adhering thereto, and subsequent treating of the seed with a disinfectant saves many seedlings that would otherwise die of disease, thus making possible a lower seeding rate. Supporting data are presented. C.

**Seed Cottons: Characteristics and Ginning.** W. S. Smith, W. J. Martin and N. L. Pearson. *J. Agric. Res.*, 1943, 66, 249-260 (through *Exp. Sta. Rec.*, 1943, 89, 59). Sixteen cotton varieties grown at Stoneville, Miss., 1936-37, differed significantly in the time (minutes) and net energy (watt-hours) required to gin either 30 lb. of seed cotton or enough seed cotton to produce 10 lb. of lint. The larger and more fuzzy-seeded cottons took longer and required more energy to gin than the smaller and less fuzzy-seeded varieties. Varieties with a high lint percentage required less time and energy to gin 10 lb. of lint than cottons with low lint percentage. Whilst lint percentage had little effect upon the energy needed to gin 30 lb. of seed cotton, an increase in lint percentage tended to increase the time. Strength of fibre attachment to the seed had no effect upon the energy requirement. C.

**Sea Island Cotton: Costs and Returns in Puerto Rico.** L. M. Géigel. *Puerto Rico Univ. Sta. Bul.* 61, 1942, *Span. ed.*, 41 pp. (through *Exp. Sta. Rec.*, 1943, 89, 494). Information from 140 Sea Island cotton plantings in 1939 and 210 plantings in 1940 was obtained. Analysis is made of the costs of production and the variations in and the factors affecting such costs and returns. Share-croppers planted 62 per cent. of the crop in 1939 and 71 per cent. in 1940. The average yields of seed cotton per cuerda (0.97 acre) and the average price of the seed per pound were 498 lb. and 8.7 ct. in 1939 and 674 lb. and 9.1 ct. in 1940. The average costs of production per cuerda and per quintal were \$29.67 and \$5.96 in 1939 and \$37.21 and \$5.53 in 1940. The net returns were \$13.68 and \$2.74 in 1939 and \$24.29 and \$3.59 in 1940. Growing costs per cuerda were about the same on soils of high, low or medium productivity. Tenure had no material effect on net returns. The farmers making the highest returns had yields above 700 lb. of seed cotton per cuerda, applied more than 400 lb. of fertilizer per cuerda, harvested over 95 per cent. of first-class cotton, cultivated relatively small- to medium-sized plantings, and used from 120 to 160 hours of labour in growing operations on the soils of high productivity and 120 hours on the medium and poor soils. C.

**Bast-fibre Plants: Fibre Content Determination.** G. Bredemann. *Faserforschung*, 1942, 16, 14-39 (through *Chem. Zentr.*, 1943, 1, 467-468 and *Chem. Abstr.*, 1944, 38, 3471<sup>4</sup>). A conventional method is described according to which the samples, after a suitable pretreatment, are subjected to a predigestion, a main digestion and a cleaning process by spraying them on screens. *Hemp*: the carefully cleaned male and female stems are boiled for 2 hours in sodium carbonate; the removed bark is calendered, boiled for 2 hours with 2 per cent. caustic soda at 2 atm. pressure and sprayed with water. *Flax*: boil 0.5 hour with 1 per cent. sodium sulphite; do not calender bark, continue as for hemp. *Nettles*: boil for 2 hours with 0.4 per cent. sodium carbonate, then continue as for hemp. The fibres obtained are pure. C.

**Cotton Bolls: Growth.** D. B. Anderson and T. Kerr. *Plant Physiol.*, 1943, 18, 261-269 (through *Exp. Sta. Rec.*, 1943, 89, 662). Daily and seasonal variations in the diameters of cotton bolls of the Rowden, Half-and-Half, Coker 100, Cook, and D. and P.L. varieties of upland cotton were recorded during the summers of 1940-42. Enlargement of young bolls was not inhibited by severe wilting of the parent plant. Full-sized bolls shrank in size when the parent plants were visibly wilted and regained their size during the night if low soil moisture was not a limiting factor. Degree of shrinkage of full-sized bolls was, in general, proportional to the severity of wilting of the parent plant. During periods of severe drought, shrinkage occurred later in the day and recovery during the night was partial or even entirely absent. C.

**Cotton Crop: Improvement in South East Missouri.** J. R. Paulling. *J. Amer. Soc. Agron.*, 1943, 35, 409-412 (through *Exp. Sta. Rec.*, 1944, 90, 42). Progress and accomplishments in the Missouri cotton improvement programme are reviewed for the period 1936-42. C.

**Cotton Plants: Tolerance to Soil Salts.** N. A. Henkel and S. S. Kolotova. *C. r. Acad. Sci. U.R.S.S.*, 1943, 39, 209-212 (through *Brit. Chem. Physiol. Abstr.*, 1944, B III, 123). When the leaf stems are immersed in various salt solutions, and the leaves are exposed to diffused daylight, yellow spots and patches appear after varying lengths of time, depending on the tolerance of the given variety to the salts. Leaves of plants grown in salty soils exhibit high tolerance, and yellowing appears only when the salt concentration of the leaf juice is much greater than that found in normal plants exhibiting an equal degree of chloroplast destruction. C.

**Vetches: Manurial Value for Cotton.** C. D. Hoover. *Soil Sci. Soc. Amer. Proc.*, 1942, 7, 283-289 (through *Exp. Sta. Rec.*, 1944, 90, 46). In vetch fertilizer experiments, 1939-42, on Grenada silt loam, drilling lime and lime-fertilizer mixtures under hairy vetch was superior to ordinary planting methods. Vetches so treated produced nitrogen equivalent to 36 lb. per acre of commercial nitrogen as measured by cotton yields. Lime drilled into soils deficient in calcium might increase the nitrogen content of vetch as much as one-third as compared with unfertilized vetch. Vetch with a high nitrogen content decomposed faster than that low in nitrogen. C.

**"Whole Cotton": Growing and Processing.** F. K. Cameron. *J. Elisha Mitchell Sci. Soc.*, 1943, 59, No. 1, 1-13 (through *Exp. Sta. Rec.*, 1943, 89, 662). A practical account of the growing and processing of the whole cotton plant for oil and  $\alpha$ -cellulose. Cotton is planted close some weeks later than usual in the locality, matures about 25-30 weeks after planting, and is cut and baled. Seed cotton comprises 60 per cent. of the mass of whole cotton, leaves 2 per cent., and the remainder is about equally divided between cusps and stems. Cultural, harvest and storage methods, production costs, preparation for processing, recovery of cottonseed oil and pulping whole cotton and costs, cellulose derivatives, and uses of cellulose from whole cotton are discussed. C.

**Cotton Root Rot: Effect of Rainfall.** W. N. Ezekiel. *Texas Acad. Sci. Proc. and Trans.*, 1941, 25, 63-68 (through *Exp. Sta. Rec.*, 1943, 89, 630). The greatest economic damage by *Phymatotrichum omnivorum* in Texas is in cotton fields, where root rot often kills the plants in areas so large as to be visible even from aeroplanes. From the statistical studies presented, the conclusions are drawn (1) that the final percentage of root rot within areas of favourable soils is almost exactly a linear function of the rainfall during the several preceding months, with the same amount of rainfall having a greater effect later in the season, and (2) that beyond an optimum amount for a particular month, additional rainfall will not cause further increase in the percentage of root rot. Rainfall more effectively promotes root rot later in the season because young cotton plants are resistant. The root rot fungus and the cotton plant are both affected by the rainfall in somewhat the same manner. In years of favourable rainfall, yields may be higher even in root-rot areas, but this higher yield is still very much less than would be obtained were the disease absent. The disease thus tends to equalise cotton production on the particular farms on which it occurs at the drought level, causing meanwhile a percentage crop reduction that approaches the percentages of plants killed by root rot. These factors explain why, when average figures over an area are taken, increased yields may be directly correlated with increased prevalence of root rot. C.

**Cotton Varieties: Resistance to Fusarium Wilt Disease.** V. H. Young and L. M. Humphrey. *Arkansas Sta. Bul.* 437, 1943, 23 pp. (through *Exp. Sta. Rec.*, 1944, 90, 64). This study revealed marked genetical differences among cotton varieties as to wilt resistance and yield, but indicated also that environmental factors may greatly modify the expression of these differences. Varieties susceptible under favourable conditions include some giving high yields, good staples and high gin turnouts, whereas others, such as Half-and-Half, are inferior in staple length. Clearly, no highly susceptible varieties should be grown under conditions favouring the disease. Another group comprises varieties such as some strains of Rowden, developed in Arkansas, that are "wilt tolerant." Except where conditions are extremely favourable to infection such cotton is believed to offer the best present solution to the wilt problem in the State. A comparatively small number of varieties exhibit very high resistance, but whilst none of those now available can compete with some of the less wilt-resistant varieties on non-wilt or low-wilt soils, where conditions favour the highest wilt incidence no other varieties will succeed. If cotton must be grown in such areas, it is recommended that only some highly resistant variety such as Rhyne Cook be used. C.

**Bollworm Eggs and Larvae: Natural Control.** R. K. Fletcher and F. L. Thomas. *J. Econ. Entomology*, 1943, 36, 557-560 (through *Exp. Sta. Rec.*, 1944, 90, 224). A report is made of investigations of certain of the biological factors affecting the eggs and first instar larvae of the bollworm and their relative importance in relation to the possible survival of early stages. Assuming that all the eggs and larvae that were not known to be destroyed by predators or parasites hatched and completed development, the conclusion is reached that not more than 61 per cent. of the eggs laid by the bollworm develop beyond the first instar under field conditions. C.

**Cotton Aphid: Control.** E. H. Floyd, I. J. Becnel and C. B. Haddon. *Louisiana Sta., Northeast Louisiana Sta. Biennial Rpt.*, 1941-42, pp. 27-31 (through *Exp. Sta. Rec.*, 1943, 89, 711-712). Yields of seed cotton in Louisiana per acre from plats treated in 1941 with calcium arsenate, 10 per cent. sulphur, and 0.5 per cent. rotenone; calcium arsenate; calcium arsenate and 1 per cent.

nicotine; and calcium arsenate, 10 per cent. sulphur, and 0.2 per cent. pyrethrins were 1,384.0, 1,258.4, 1,674.4, and 1,368.0 lb., respectively, compared with 1,269.6 lb. for the untreated check. In 1942, treatment with calcium arsenate plus 1 per cent. nicotine; calcium arsenate plus 2 per cent. nicotine; 1 per cent. nicotine and a proprietary dust; and calcium arsenate alone resulted in yields of seed cotton of 3,019, 3,035, 3,062, and 2,835 lb. per acre, respectively, compared with 2,970 lb. from the untreated check. It appears that nicotine used at 1 per cent. concentration in every application of calcium arsenate or at 2 per cent. in alternate applications is equally effective.

C.

**Cotton Aphid: Damage and Control in Texas.** K. P. Ewing. *J. Econ. Entomology*, 1943, 36, 598-601 (through *Exp. Sta. Rec.*, 1944, 90, 223). In two experiments conducted at Waco, Texas, in 1942, it was shown that reductions in cotton yield of 164 and 243 lb., respectively, of seed cotton per acre, could be attributed to cotton aphids. Nicotine sulphate mixed with calcium arsenate to contain 0.5 per cent. of nicotine did not satisfactorily control the aphid. Calcium arsenate in alternate applications with calcium arsenate plus 2 per cent. of nicotine and calcium arsenate plus 1 per cent. of nicotine in each application gave considerable control of the aphid, the former being slightly better. Cryolite produced a lower infestation of aphids than did calcium arsenate. Early morning applications of calcium arsenate plus 1 per cent. of nicotine were more effective in controlling the aphid than were midday applications. A non-dusted buffer of 30 ft. or more greatly reduced the migration of aphids between plats.

C.

**Cotton Bolls: Effect of Boll Weevil on Production.** A. L. Hamner. *Miss. Farm Res. [Mississippi Sta.]*, 1943, 6, No. 6, pp. 4-5 (through *Exp. Sta. Rec.*, 1943, 89, 717). Cotton plants react to the loss of squares punctured by the boll weevil by setting a higher percentage of the young bolls and by producing heavier bolls. A higher percentage of young bolls that matured was produced on plants that had as few as 10 per cent. of the squares removed throughout the season than on untreated checks. When bolls were protected from weevil damage, fewer were required to make a pound of seed cotton on the treated plats than on the check. With the exception of a few bolls set early and late in the season, four varieties of cotton set approximately 80 per cent. of their crop during the first 5 weeks of fruiting and over 70 per cent. during the second, third, fourth and fifth weeks.

C.

**Cotton Insects: Control in Peru.** F. F. Bibby. *J. Econ. Entomology*, 1942, 35, 193-197 (through *Brit. Chem. Physiol. Abstr.*, 1944, B III, 127). The use of arsenicals, particularly calcium arsenate dust, for control of leaf worms on cotton produced a severe aphid infestation during the summer which could be prevented by using a cryolite (20 per cent.)-sulphur (80 per cent.) dust, or cubé root (0.75-1.5 per cent. of rotenone)-sulphur on an inert carrier instead. The rotenone-sulphur dust was suitable for controlling spring infestations of aphid. The Peruvian weevil, *Anthonomus vestitus*, was controlled with calcium arsenate or a cryolite-sulphur mixture, the latter being preferable as preventing subsequent aphid infestation. Sulphur alone or with nicotine sulphate to give a 2 per cent. nicotine mixture gave satisfactory thrips control. Arsenicals for leaf- or cut-worm should be used only as bran baits.

C.

**Mirid Bug: Control.** H. F. G. Sauer. *Arg. Inst. Biol. [São Paulo]*, 1942, 13, 29-66 (through *Exp. Sta. Rec.*, 1944, 90, 224). Investigations of the life history, habits, and control of the mirid bug *Horcius nobilellus*, conducted in the State of São Paulo, are reported. During the last 4 years this insect has caused severe losses in many cotton fields extending over a rather wide area of the State. Its injury is manifested by excessive shedding of small squares, blossoms and immature bolls and the suppression of fruiting branches. Technical descriptions are given of the adult and immature stages. Cultural control measures are recommended. The application of sulphur or a mixture of 80 per cent. sulphur and 20 per cent. Paris green or 66 per cent. sulphur and 33 per cent. calcium arsenate, as a dust, gives effective control if used at the rate of 12.5-16 lb. per acre, and 4-5 applications at 8-10-day intervals are employed when the population of the plant bug begins to increase more than 8 per cent.

C.

**(D)—ARTIFICIAL**

**Polyacrylonitrile Fibres: Spinning.** Y. Mamiya, S. Matui and S. Kanbara. *J. Soc. Chem. Ind. Japan*, 1941, 44, 125-126 B (through *Chem. Zentr.*, 1943, i, 802 and *Chem. Abstr.*, 1944, 38, 3481<sup>9</sup>). Acrylonitrile, bp. 77-80°, *d.* 0.807, was prepared and polymerised to a degree of 12,000-16,000. A 1.4 to 3.1 per cent. solution in Na or K thiocyanate was spun. Mixtures of lower alcohols, e.g. ethyl and propyl alcohols, were used as precipitation baths. Threads of 0.9-1.2 denier and *d.* 1.008-1.108 were prepared. The strength was up to 1.9-2.4 g./denier at 19-36 per cent. elongation. Dry heat up to a temperature of 130° does not damage the fibre, but causes shrinking; at 170° the fibre turns brown; decomposition begins at 215°. Hot water does not damage the fibre, but 1 per cent. caustic soda is injurious. C.

**Rayon Spinning Bath: Control of Composition.** A. Wehrung. *Chem. App.*, 1941, 28, 119-121, 132-137 (through *Chem. Zentr.*, 1941, ii, 2636-2637 and *Chem. Abstr.*, 1944, 38, 3468<sup>8</sup>). Various methods are described for the evaporation of the water which must be removed to insure a constant composition of the precipitating bath, or to crystallise the salt, and for recovering the components. During the evaporation process a part of the water is removed to facilitate the crystallisation, and the remaining part to maintain a constant composition of the bath. The ratio changes with the salt composition of the bath. The course of the evaporation and the expenditure of the reagents depend on the amount of the excess of the salt in the precipitating bath. Increasing the content of salt decreases the acid-salt solution in the newly formed fibre. The fibre so obtained is of a higher quality. Suitable apparatus is described and its costs given. Under mass-production conditions, it is economically practical to use the spinning bath for recovering the acid and salt. C.

**Viscose Rayon: Causes of Milky Striations.** W. Kling and H. Schwerdtner. *Textilberichte*, 1942, 23, 333-340 (through *Chem. Abstr.*, 1944, 38, 3468<sup>4</sup>). Commercial products were subjected to an extensive and thorough microscopic and chemical examination which showed that it is necessary to distinguish between a true and a simulated milky streakiness. The microscopic study of cross-sections showed that the true effect is characterised by the existence of a sponge-like hollow space between the outside layer and the nucleus of the fibre. A part of this hollow space appears to be filled with an organic substance, and the streakiness is increased by treatment with suitable extracting agents. A simulated milky streakiness may be due to various causes. A poorly desulphurised viscose rayon and several samples containing inorganic deposits, particularly zinc compounds, were studied. Chief causes of milky streakiness are (1) excessively high carbon disulphide concentrations during sulphonation, (2) insufficient ripeness of the viscose and (3) poor adjustment of the precipitation baths, particularly excessively high concentrations of sulphuric acid or zinc sulphate or excessively high temperature of the precipitation bath. The defect may be made more or less visible by washing, brightening and drying treatments. Thus, strong cleaning and brightening agents can make the defect more noticeable; on the other hand, fillers like mineral oil emulsions can make it less noticeable. C.

**Alkali-cellulose: Ripening; Effect of Metal Carbonyls.** G. A. Schröter. *Kolloid Z.*, 1943, 105, 223-225 (through *Chem. Abstr.*, 1944, 38, 3838<sup>5</sup>). Iron carbonyls, in gaseous phase, are absorbed by technical alkali cellulose (from beech and spruce sulphite pulps) and hasten the ripening process. At 40° the ripening time for beechwood alkali-cellulose was reduced by half, when the cellulose had an iron content (from the carbonyl) of 30 mg. per 100 g. cellulose. Nickel carbonyl gas was not absorbed to as large an extent as the iron carbonyl, and had less effect on the ripening time. Spruce sulphite pulp impregnated with nickel sulphate, dried, and then made into alkali-cellulose, ripened more rapidly than unimpregnated pulp. C.

**Viscose Solution: Mixed Molecular Chain State.** J. J. Stöckly. *Kolloid Z.*, 1943, 105, 190-199 (through *Chem. Abstr.*, 1944, 38, 3837<sup>9</sup>). In the various stages of viscose production, such as sulphiding, solution, ripening and decomposition, the "solution state" of the viscose plays an important role. A technical cellulose spinning solution is conceived as consisting of a mixture of bundles of esterified, etherified and solvated chain molecules, designated as

“mixed chain molecules.” The relationship between this concept and previous theories of solution state dealing with mesophases, myelin figures, and mixed little rods, is defined. The concept of mixed-chain molecules is in excellent agreement with the important phenomena observed in solution of the cellulose xanthate, in the process of ageing, in coagulation and in decomposition of the viscose, as well as with the properties of the regenerated cellulose. It also helps to clarify a number of hitherto confused and contradictory ideas on the preparation and spinning of viscose. C

#### PATENTS

**Water-soluble Polyvinyl Ester Filaments: Production.** R. P. Roberts, E. B. Johnson and H. H. Taylor. B.P. 563,960 of 21/11/1942: 7/9/1944. Filaments, foils and similar articles which swell or dissolve in water are produced by shaping and setting solutions of polyvinyl esters containing free hydroxyl groups in which the ester group content is between 2 and 12 per cent. of the maximum theoretically possible. Preferably the polyvinyl ester employed contains acetyl groups. The filaments are preferably produced by extruding an aqueous solution of the polyvinyl ester into a coagulating medium containing acetone, and it is also preferred to subject them to a stretching operation in the presence of a softening agent such as moist air or steam, in order to increase their tenacity. C.

**Rayon Staple Cutting Apparatus.** American Viscose Corporation. B.P. 563,983 of 12/4/1943: 7/9/1944 (Conv. 30/4/1942). Apparatus for cutting continuous filaments into staple fibre is provided with means for directing alternate cuts into separate discharge channels. Means may be provided for causing successive cuts to differ in length, each alternate cut of the same length being directed into the same separate discharge channel. The fibres of an individual cut may vary in length, alternate cuts of the same variation in cut being directed into the same separate discharge channel. The apparatus may comprise a rotatable member for feeding continuous filaments outwards therefrom, cutting devices disposed at a number of points about the rotatable member, and separate discharge channels associated with each of the cutting devices. Means may be provided for adjusting the position of at least one of the devices about the periphery of the member. C.

**Viscous Liquid Deaerating Apparatus.** British Cellophane Ltd. B.P. 564,153 of 16/7/1942: 14/9/1944 (Conv. 18/7/1941). Apparatus for deaerating viscous liquids under vacuum is fitted with means for determining the temperature of the (a) incoming liquid, and (b) the liquid just above the liquid level in the lower part of the container, and thermo-regulated means for controlling the vacuum. C.

## 2—CONVERSION OF FIBRES INTO FINISHED YARNS

### (A)—PREPARATORY PROCESSES

**Vertical Cotton Opener: Curling Action on Fibre.** *Cotton (U.S.)*, 1944, 108, No. 7, 128-129. The writer proffers answers to the question, “Does the vertical (Creighton) opener curl the cotton as it is swirled around while passing through the conical beater?” He claims that the Creighton opener is a more effective machine for cleaning than for opening, so that the position of the machine in the blowroom sequence is the ruling factor. He suggests as a satisfactory sequence: six blending feeders (two converted from a tandem feeder and two from a bale breaker), delivering 250-275 lb. of cotton per hour to a blending apron, a vertical opener, tandem lattice openers, and a Centrif-air machine. The action of the vertical opener is discussed and hints are given on its maintenance. C.

**Carding Engine: Speeds, Settings and Maintenance.** Textile Operating Executives of Georgia. *Textile World*, 1944, 94, No. 6, 98-99. Replies by the managers of twenty American mills (total spindlease 1,051,000) to a questionnaire on carding are analysed. They relate to (1) the beater speed for a blowroom system producing a 45-lb. lap, 13½ oz. per yd., every 6½ minutes, from ¾ in. Strict low middling cotton; (2) the relative merits of continuous, vacuum and hand methods of stripping; (3) grinding of cylinders, doffers and lickers-in; (4) the effects of reducing flat speeds from 3 to 1½ ins. per minute; (5) methods of checking waste and weight; (6) the merits of condenser drawing. Considerable divergences of opinion are revealed. C.



**Rayon Staple Fibre: Processing on Cotton Machinery.** F. S. Culpepper. *Textile World*, 1944, 94, No. 3, 70-73; No. 4, 116-117; No. 5, 109; No. 6, 119. Practical hints are given on opening, scutching, carding, drawing, speed frame processing and spinning of rayon staple, with particular reference to speeds and settings. Typical breaking loads are tabulated for various staples in singles yarn from 5s to 100s. The last instalment gives the complete organisation for spinning 30s. C.

**Slubbing Frame Roller Covers: Relation to "Eyebrowing."** E. H. Helliwell. *Textile World*, 1944, 94, No. 7, 66-67. The author discusses the conditions under which roller clearer waste becomes attached as "eyebrows" to speed frame products, thus causing slubs in yarn and cloth. He reports a test in which high-draft slubbing top rollers were covered with (1) plain calfskin, (2) calfskin embossed with a fine pebbly surface, (3) plain cork, (4) a composition with fine ground cork in it, and (5) a synthetic product, and, after "running them in" for a week, with stationary clearers, records were taken of (a) the weight of clearer waste per hour, (b) the place where the waste accumulated on the clearer, (c) the length of time that elapsed before the waste made contact with the strand, and (d) the nature of the waste. The data are tabulated. Under (a) there was little difference in the amount of waste, but under (b) it was found that coverings Nos. 3, 4 and 5 tended to deposit the waste at the front so that it hung down as a curtain and made contact with the strand more frequently than the doffing period. With the calfskin covers, the waste was carried well back, No. 2 even rather too far back, so that the waste could be dealt with easily at doffing time. Covers 3, 4 and 5 gave short, neppy waste, but with 1 and 2 the waste contained some long fibre. Some comments are offered on the use of revolving clearers. C.

**Roving: Variability.** *Cotton (U.S.)*, 1944, 108, No. 7, 129-130. The writer gives hank numbers obtained at four  $10 \times 5$  intermediate frames on two-process drawing from  $1\frac{1}{2}$  in. cotton. The extremes in 20 numbers are 0.878 and 0.922 (nominal, 0.9). C.

**Noble Comb: Criticism.** W. H. Robinson. *Wool Rec.*, 1944, 66, 276-277, 279-280. The Noble comb is discussed and improvements suggested. Oiling and greasing, and circle cleaning could be more satisfactorily done automatically, with consequent improvement in production. Intersecting sector circles could be tried, and, if successful, would both eliminate the dabbing brush and reduce the many detrimental effects which are directly due to the compression of fibres at the base of the pins by the force of the dabber. The use of drawing-off leathers is neither economical nor highly efficient, and methods should be investigated for increasing the life of combing leathers and for removing the combed fringes from the circle pins, forming them into a sliver, and transporting them into the coiler can. The following factors in Noble combing efficiency merit special consideration: the very small part of sliver between the two circles at the dabbing point which does not pass through the intensive final combing action; the danger of fibre breakage at the outside drawing-off roller point due to the compression of fibres at this point and the lack of a straight drawing-off action. W.

**Combing Machines: Comparison.** "Tex." *Wool Rec.*, 1944, 66, 236, 237, 239. A description of the distinctive features of Noble and rectilinear combs. W.

**Automatic Feed for Woollen and Worsted Cards.** Proctor & Schwarz Inc. *Text. World*, 1944, 94, No. 4, 122. The feed is driven by a separate electrically-controlled motor operated by a mercoide switch resting against the end of the scale arm. When the scale pan has received its weighing, the end of the beam rises and the switch falls forward, cutting off the current from the motor and stopping the spike apron. The drive dispenses with mechanical clutch mechanisms. The trap door over the scale pan operates in conjunction with the electrical control, by means of a solenoid and a spring mechanism. The weight of the mechanism on the scale arm has been greatly reduced. A compensating device located in the hopper ensures that an even amount of material is fed to the spike apron. Improved types of combing mechanisms and a beater with a receding-pin stripper motion are also incorporated in the feed. W.



## (B)—SPINNING AND DOUBLING

**Ring Frame Top Clearer: Modification to Prevent "Eye-browning."** *Cotton (U.S.)*, 1944, 108, No. 7, 130-131. The writer believes that a common cause of "eye-browning" with synthetic plastic roller cots on high-draft ring frames is that the clearer board is not heavy enough. He describes a modification that holds the waste for more than four hours without trouble. A piece of strap iron,  $16 \times 1\frac{1}{2} \times \frac{1}{8}$  ins. is screwed to the board and this is fastened to a bent rod that passes through a bracket mounted on the cap bar rod. The board will thus stand up by itself for attention to the rollers. The extra weight is about 1 lb. C.

**Spinning Frame Assignment Constants: Calculation and Application.** F. H. Gunther and M. Gross. *Textile World*, 1944, 94, No. 6, 95. The calculation of the number of frames required to feed a given number of looms is simplified by making a constant out of the ratio of pounds of yarn consumed per loom per working week to the pounds of yarn produced per frame. Thus, for a loom consuming 32.10 lb. of 17s weft per 40 hr.-week and a frame producing 410 lb. of the yarn, the constant is  $32.10/410 = 0.0783$ . To feed 225 looms would require  $225 \times 0.0783 =$  nearly 18 frames. C.

**Spinning Problems: Discussion.** Textile Operating Executive of Georgia. *Textile World*, 1944, 94, No. 7, 73-74; *Cotton (U.S.)*, 1944, 108, No. 7, 98-100. Replies to a questionnaire from a number of mills are reported on the following topics: (1) *Humidities in high-draft spinning.* A common figure is 55 per cent., but figures as high as 65-70 are also reported. (2) *Female doffers:* Few mills report satisfactory experience with female doffers. (3) *Synthetic products for roller covers:* Several mills report favourably, but recommend revolving front clearers to obviate "eye-browning." (4) *Scavenger rollers:* A variety of preferences are expressed for plush, paper and blue denim covers. (5) *Bobbin building:* Various types of winding and bunch building are discussed. C.

**Single Roving Worsted Ring Yarn Production.** Victor Ring Traveler Co. (U.S.A.). *Text. Mfr.*, 1944, 70, 305. Single-end roving in worsted preparation eliminates one drafting operation, reduces waste and increases production. A uniform sliver is produced by weighing (1) at the weigh box, and (2) at the first finisher, next to the weigh box. A table compares the layouts used in the single- and double-end methods for spinning 40s from fine wool (American grade). W.

## (D)—YARNS AND CORDS

**Hand-knitting Yarns: Production.** "K.M.G." *Wool Rec.*, 1944, 66, 366-367, 369. The production of hand-knitting yarns is described, with special reference to the suitability for different types of wool of the various preparing and subsequent processes. W.

## PATENTS

**Carding Engine.** D. Walsh. B.P.562,740 of 31/3/1943:13/7/1944. A carding engine is provided with means for passing a current of air beneath the rotating parts, i.e. the taker-in, card cylinder and doffer, to one end of the engine, the space through which the air passes being enclosed and having transverse baffles extending across the enclosed space from side to side of the frame, to prevent upward flow of the air to the rotating parts, thus preventing its interference with the carding operation, while enabling the air to convey the fly which is deposited on the baffles to the said end of the carding engine for discharge. Three co-operating baffles may be mounted under the rotating parts and devised to receive fly from the rotating parts and to direct it downward into the air current. The baffles may be made of thin material and capable of vibrating when the engine is working to assist the downward passage of the fly deposited on them. C.

**Carding Engine Eccentric Mechanism.** J. Pickles. B.P.564,035 of 4/3/1943: 11/9/1944. In eccentric mechanism for reciprocating the rubber rollers, leathers or like devices in carding engines, a non-metallic flexible coupling (either with or without a spring metal reinforcement) is provided between each eccentric strap and the co-acting cross-head of the shafts of the rubber rollers, leathers, or like devices. The eccentrics may also be provided with ball or roller bearings between the eccentric sheave and the eccentric strap. C.

**Drafting Mechanism.** Dominion Textile Co. Ltd. (Montreal). B.P. 564,188 of 7/9/1942:18/9/1944 (Conv. 3/9/1941). A drafting mechanism of the kind having a pair of small control rolls arranged behind the front drafting rolls close to the nip, and a roll for clearing the bottom control roll of waste is characterised by the provision of a pair of arms for holding the clearer roll yielding against the bottom control roll, supported on a member that is weighted to counter-balance the weight of the arms and of the clearer roll and is formed in two parts to which the arms are respectively fixed, whereby removal of the clearer roll is facilitated. C.

**Card Clothing Mounting Machine.** A. Abbey (Kardbeslag Fabriks Aktiebolaget; Norrköping, Sweden). B.P. 564,214 of 12/3/1943:18/9/1944. A machine for mounting fillets of card clothing on the drums or rolls of carding engines, includes a braking device for producing a certain tension on the fillet, characterised in that it is freely movable on a guide bar, and in that an auxiliary braking device is arranged in the path of the fillet to produce a pull on the portion of fillet between the braking devices, the pull acting longitudinally of the guide bar. The auxiliary braking device preferably comprises a braking disc provided with friction coating for the fillet. In order to adjust the braking force of the braking disc, it may be adapted to be forced at variable pressure against a stationary part and/or may be provided with means for varying the angle of contact between the fillet and the braking disc. C.

**Sliver Condensing Apparatus.** Dominion Textile Co. Ltd. (Montreal). B.P. 564,577 of 9/11/1942:4/10/1944 (Conv. 20/6/1942). In a method of condensing sliver of fibrous material, the sliver is continuously passed between a pair of condensing rolls having a groove and a mating tongue after the sliver has been first reduced in width to substantially that of the groove while being allowed to expand in a transverse dimension, the sliver while passing through the groove being condensed between the tongue and the groove and the side walls of the groove in the transverse direction. Apparatus for carrying out this method comprises in combination a pair of co-operating condensing rolls, a groove on one roll mating with a tongue on the other, and a member positioned adjacent to the rolls for the first condensing of the sliver, the member including a narrow sliver-constricting passage leading to the groove. Preferably, the member for the first condensing of the sliver has a funnel portion or tapering mouth forming an entrance for the sliver to the passage and is adapted to condense the sliver into a ribbon-like form and to retain it in this form until it enters the groove of the pair of condensing rolls. A large amount of the condensed sliver may be inserted into a can by packing the coiled sliver into the can under pressure. C.

### 3—CONVERSION OF YARNS INTO FABRICS

#### (A)—PREPARATORY PROCESSES

**Nylon Yarns: Preparation for Weaving and Knitting.** J. P. Ransom. *Cotton (U.S.)*, 1944, 108, No. 5, 85-88; No. 6, 93-96, 126; No. 7, 95-97, 136. Practical advice is given on twisting, twist setting, knot tying, single-end sizing, coning and oiling of nylon yarn. C.

**Nylon Yarns: Winding, Sizing and Weaving.** E. I. Du Pont de Nemours & Co. *Rayon Textile Monthly*, 1944, 25, 277-281. Practical advice is given on (1) suitable tensioning devices for winding, (2) knot tying, (3) single-end sizing, (4) oiling, (5) tinting and marking, (6) control of static electricity, (7) winding off dense packages, (8) warping, (9) tape sizing, (10) weft winding, and (11) weaving, of nylon yarns. C.

**Rayon Tyre Cord: Twist Setting by High-frequency Heating.** Industrial Rayon Corporation. *Textile World*, 1944, 94, No. 7, 105; *Rayon Textile Monthly*, 1944, 25, 285. A picture is given of the working bench at which rayon tyre cord on 18-lb. cones is passed through a high-frequency electric field whereby heat is generated internally. Each unit has an output of about 22,500 B.Th.U. per hour and can deal with several thousand pounds of tyre cord per 24 hours. C.

**Warping Combs and Reeds.** Frank Kaufmann. *Rayon Textile Monthly*, 1944, 25, 331-332. Brief descriptions are given of various types of comb and reed used in warp preparation, with illustrations of (1) the tape type of spring

extension comb, (2) the screw type ditto, (3) the positive expansion comb, (4) the fan reed holder and (5) a warp leasing device with swing comb for holding the split rods and hook reed. C.

(B)—SIZING

**Laboratory Tape Frame.** J. M. Cook. *Textile Research*, 1944, 14, 188-193. A laboratory tape frame for small lots of cotton warps consists of a narrow steel frame approximately 36 in. high, on which are mounted the guide rods, combs, squeeze rollers, and leasing rollers. The size box and drying chamber are attached to the frame between the floor and the top. On the T-shaped front of the machine is mounted a movable carriage, equipped with rollers that allow it to be rolled from side to side on the frame. Bearings for the loom beam, a variable speed drive, and bearings and shafts for driving the squeeze rollers are mounted on this carriage. The variable speed drive permits the slashing of yarn at speeds ranging from about 4 to 23 yards per minute. Yarn bobbins from the spinning frame are placed in the creel and the yarn is pulled between polished guide rods mounted at the rear of the machine and through a comb made from a fine shortened reed. It then passes over a roller, through the size box, between squeeze rollers and over and under rollers in a drying chamber in which the temperature of the air is controlled by a thermostat. The dried yarn then passes to lease rollers, through an expansion comb, and on to a loom beam. The beam is of the usual diameter, but is constructed in sections, the sections being separated by aluminium discs. The size box consists of an inner copper shell, an outer shell, and a wooden box in which the shell rests. The outer shell contains glycerin in which is submerged an electric heating element which is thermostatically controlled. The squeeze rollers are about 3 in. in diameter, the bottom one being driven from the loom beam and the top one being covered with rubber about  $\frac{3}{8}$  in. thick. Photographs, diagrams and notes on the use of this machine are given. C.

**Rayon Crêpe Yarn: Dressing.** S. J. Miller. *Textile World*, 1944, 94, No. 6, 113. Practical hints are given on the dressing of rayon crêpe yarn to secure uniformity in the fabric. Particulars are given of four mixtures of oil and size (gelatin) for soaking and a table shows which recipe is appropriate for each of a wide range of crêpe yarns. C.

**Rayon Warp: Sizing; Tensions and Stretch.** J. J. Sussmuth. *Rayon Textile Monthly*, 1944, 25, 283. The author discusses the importance in rayon sizing of controlling the three tensions (a) from the warp beam to the point where the size is applied, (b) from this point to the first drying cylinder and (c) from the last cylinder to the weaver's beam. C.

**Sweet-potato Starch: Application.** C. W. Bendigo. *Textile World*, 1944, 94, No. 6, 123. It is reported that plant for the production of more than 100 tons of sweet-potato starch daily is under construction in Florida. Experience during the past 10 years in the application of the starch in sizing is briefly reviewed. It appears to give best results on fine yarns, but has been used to good effect on 20s. Suggested recipes for (a) difficult and (b) light warps are, for 100 gallons:—starch (a) 120, (b) 80 lb.; tallow (a) 6, (b) 4 lb.; size taken up (a) 7-12, (b) 6-9 per cent.; cooking time, 2 hours; storage temperature 180° F.; sow box temperature, 205° F.; squeeze roller, 210 lb. C.

**Tape Frame: Automatic Control.** Tallassee Mills Inc. *Textile World*, 1944, 94, No. 7, 64-65. An illustrated account is given of steps taken to secure (1) elimination of excessive stretch in the warp, and (2) tension control and consequent regularity of beam density, by fitting Reeves variable-speed transmission units at (1) the main drive of the tape frame, (2) the size rollers, and (3) the loom beam, and placing these units under control from the Brown "Moist-o-Graph" moisture recording panel. C.

(C)—WEAVING

**Loom Reeds: Selection.** H. E. Wenrich. *Rayon Textile Monthly*, 1944, 25, 284-285. Practical hints are given on the selection and care of pitch band, stainless steel and all-metal reeds and on how to centre the reed in the loom and to prevent "wash-boarding" of shuttles. C.

**Cotton Looms: Adaptation to Rayon Weaving.** H. E. Wenrich. *Textile World*, 1944, 94, No. 7, 56-57. Practical hints are given on the steps to be taken (overhauling, etc.) when a cotton warp has run out and is to be

replaced by rayon. It is recommended that particulars of the new cloth should be posted in the weaving shed a few days ahead of the time so that tacklers and others can collect any necessary accessories and plan their work. C.

**2×2-Twill: Weaving on Six Shafts.** H. R. Mauersberger. *Rayon Textile Monthly*, 1944, 25, 289. The writer reproduces two replies to a request for a chain pattern for a 2×2 twill on a 6-shaft taffeta weave, straight and skip enter. C.

**Weaving Shed Records: Application in Improving Efficiency.** A. R. Kandler. *Textile World*, 1944, 94, No. 6, 96-97. Suggestions are made for checking the efficiency of a tackler by making systematic records of smashes, new shuttles issued, cloth defects, pick counts and stoppages. Examples are shown. Different colours are used for recording different causes, e.g. smashes due to broken bobbins, broken shuttles or incomplete transfer of bobbins, might be recorded in black, red and green, respectively. C.

#### (D)—KNITTING

**Defective Knitted Fabrics: Description and Causes.** F. J. Quilitsch. *Textile World*, 1942, 92, No. 8, 77; No. 11, 122; 1943, 93, No. 12, 75; 1944, 94, No. 2, 121; No. 7, 95. The writer stresses the utility of a reference collection of defective materials and gives brief, illustrated descriptions, with suggested causes and remedies, of defects due to fuzzy needle lines, sinker lines, oil streaks, dropped stitches, knots in decorative and other yarns, and bad latches on the needles. C.

**Knitting Room: Humidification.** *Textile World*, 1944, 94, No. 6, 109-111. A simple statement is given of the advantages of humidification in knitting circular cotton hosiery. One recommendation is to aim at a regain of 8 per cent. in the yarn. Another suggestion is to maintain the knitting room at 72-78° F. and 55 per cent. R.H. C.

**Knitted Fabrics: Design.** J. C. H. Hurd. *J. Textile Inst.*, 1944, 35, P85-92. Types of ornamentation in knitted fabrics and garments are discussed. The term "design stitch unit" is introduced to represent the stitch or group of stitches forming a unit of the ground or the design effect in a patterned area, and examples of design stitch units and their combination in fabrics are considered. Mechanisms used for the selection of design instruments on knitting machines, including (1) spiral type pattern wheels, (2) multi-butt pressers, selectors or discs working on a depressing principle and (3) full Jacquard mechanisms, and examples of the types of designs obtained with them are discussed. C.

#### (G)—FABRICS

**Hand-loom Designs: Production on Power Looms.** F. W. Sterling. *Textile World*, 1942, 92, No. 8, 100. Illustrations are given of some decorative fabrics that were developed on a special hand-loom but could be woven on a dobby loom. C.

**Military Rayon Yarns and Fabrics: Adapting to Civilian Uses.** *Textile World*, 1944, 94, No. 6, 100-101. The writer discusses the prospects of the transition to civilian fabrics of (1) rayon cloths made specially for war and (2) cloths made from new types of yarn (strong viscose and acetate rayon, glass filament, nylon, Vinyon, etc.). Judged by current experience in the United States the transition should be smooth. C.

**Textile Designer: Function and Mill Organisation.** T. O. Ott. *Textile World*, 1943, 93, No. 9, 79-82; No. 10, 70-72; No. 11, 98-99; No. 12, 90-91. The writer discusses the place and functions of the fashion "stylist" and the designer who translates the stylist's ideas into fabrics. The first article deals with the inter-relations of the stylist, the sales organisation and the business and technical management. The second chapter is concerned with planning the designer's work and discusses his production of a point paper diagram and a weaving specification. Chapter III describes the planning of the manufacture of sample fabrics. Chapter IV deals with the costing of new fabrics. C.

**The Rag, Shoddy and Mungo Trade.** N. C. Gee. *Text. Mfr.*, 1942, 68, 240, 267, 330, 359, 399, 443, 479; 1943, 69, 32, 76, 121, 167, 227, 271, 302, 345, 395, 436, 482, 532; 1944, 70, 23, 67, 117. A series of illustrated articles dealing comprehensively with all aspects of rag treatment and shoddy and mungo produc-

tion. The collecting, sorting and blending of rags, and the carbonising and shaking, dusting and washing, drying, stripping and re-dyeing, blending and oiling, pulling, and cleaning and opening processes are described. Details are given of types of shoddy and mungo cloths, and the identification and assessment of raw material in rags. The articles conclude with a description of garnetting machinery, and with a list of terms and definitions. W.

**Printing Machine Blankets.** *Dyer*, 1944, 92, 177-181, 187. The qualities required in a printing machine blanket are listed, and the necessity stressed for a resilient and level foundation to obtain satisfactory impressions. Old (1850-1871) and recent patents dealing with washing apparatus and with various types of blanket fabrics are surveyed. Details are given of methods of waterproofing (including the use of blood albumen) and washing and cleansing. Precautions are necessary to avoid faults due to cold or damp blankets, to variations in tension and to creasing. W.

#### PATENTS

**Warping or Beaming Machines.** F. Lambach (Tenafly, New Jersey, U.S.A.). B.P.563,756/7/8 and 563,879/80/1/2/3 of 24/7/1942:1/9/1944 (Conv. 21/11/1941). (1) A warping or beaming machine equipped with an electromotor for causing a rotation of the warp beam is characterised in the arrangement of electrical means for the adjustment of a predetermined normal speed of the electromotor and in the arrangement of controlling means automatically controlled by a member held in contact with the winding on the beam for changing the speed of the electromotor from the normal value to a lower value in dependence on the building up of the winding on the beam. (2) The system comprising a motor circuit for connecting a source of current with an electromotor arranged for driving a beam includes automatic electrical controlling means responsive to the building up of the winding on the beam, which cause a variation of the operating speed of the electromotor by a variation of the electrical conditions of the system in such a manner that a substantially constant travelling speed of the warp yarns may be obtained. (3) Both the start switch and the stop switch of the electromotor may be actuated by the same movable controlling means, and selecting means are associated with the controlling means for selecting an actuation of either the start switch or the stop switch by the controlling means. (4) An electrical control system for the operation of braking means of a warping or beaming plant is characterised in that the system comprising a motor circuit for connecting a source of current with an electromotor arranged for driving a beam includes at least one circuit opening switch for causing an interruption of the motor circuit, that an electrical control responsive to an interruption of the motor circuit is arranged in the system for causing an actuation of the braking means upon such an interruption, and that the system includes a time relay responsive to an interruption of the motor circuit for causing at least a substantial release of the braking means after a period of time determined by the delaying action of the time relay. (5) A warping or beaming machine equipped with a drive for causing a rotation of a beam having a flange on each side of its ends and having a centre hole in each of its flanges is characterised in that the machine includes a driving head connected with the drive and arranged for driving engagement with one of the centre holes of the beam, and that an idling head arranged for engagement with the other centre hole of the beam is journaled in a bracket which is movable from an operative position with the idling head engaged with the centre hole of the beam into an inoperative position wherein the idling head is disengaged from the centre hole and the bracket permits free access to the flange of the beam. (6) The reed of a warping or beaming machine is movably arranged in the machine and automatic control means are associated with the reed for lifting it during the building up of the winding on the beam, the arrangement being such that, in operation, the warp remains in a substantially plane surface whereby any variable angles in the warp are avoided and the tension in the yarns remains substantially constant. (7) A beam support is provided which is swingably mounted on a stationary point of the machine and may be lifted by adjusting means from a lower beam receiving position, wherein the beam is disengaged from the drive, into an upper operative position, wherein the beam is coupled with the drive, and locking means are arranged for holding the support in the upper operative position. (8) A beaming or warping machine equipped with a drive for causing a rotation of a warp beam and with rotatable means rotated by engagement with the warp, is characterised

in that the machine comprises actuating means for a simultaneous actuation of a braking mechanism arresting the beam, and of braking means arresting the rotatable means, in combination with compensating means for compensating differences in the action of the braking mechanism and the braking means. C.

**Warping or Beaming Machine Storage Device.** F. Lambach (Tenafly, New Jersey, U.S.A.). B.P.563,855 of 24/7/1942:1/9/1944 (Conv. 21/11/1941). A storage device for a temporary unwinding of a portion of a warp from the beam comprises a pair of relatively movable gripping means which are normally in an inactive position permitting a free passage of the warp through the storage device. Driving means are connected with at least one of the gripping means for changing their relative position so as to cause the gripping of the warp. C.

**Circular Independent Needle Knitting Machine.** Wildt & Co. Ltd., H. H. Holmes and A. P. Saunders. B.P.563,905 of 5/1/1943:5/9/1944. In a modification of the machine described in B.P.545,676 there are provided a main knitting cam system for circular knitting only, including a stitch or knocking-over cam adapted to enable inactive needles to go through the system without reverting to the knocking-over position, an auxiliary knitting cam system for reciprocatory knitting, an additional series of butts associated with the needles intended to be active during reciprocatory knitting, and jacks adapted normally to position the additional butts for engagement with the auxiliary knitting cam system, the construction and arrangement being such that butts corresponding with jacks influenced by the narrowing picker or pickers are permitted to assume an inoperative position so as to avoid engagement with the auxiliary cam system and when the same jacks are influenced by the widening picker or pickers the corresponding additional butts are re-positioned for engagement with the system. In a machine employing ordinary needles the additional butts may be provided on the stems below the ordinary knitting butts, but in a machine of the characteristic type employing double-ended needles the additional butts are provided on the sliders engaged with the needles, e.g. below the transfer butts. C.

**Nylon Sizing Compound.** J. C. E. Bessieres and H. W. Best-Gordon. B.P. 564,027 of 6/11/1942:11/9/1944. A size for nylon and other yarns comprises casein or a compound thereof, e.g. an alkali caseinate, an oil, e.g. castor oil or arachis oil, in an emulsified or colloidal state, and an amide, e.g. urea. A sulphonated oil, preferably a sulphoricinate, or a sulphonated alcohol, preferably cetyl alcohol, and gelatin may also be added. The casein or casein compound (and gelatin) may be dissolved in an alkaline solution, e.g. in a dilute aqueous solution of ammonia, soda or borax. The size may be applied to yarn at normal room temperature during winding, warping or beaming operations, or to warp threads on the loom. C.

**Circular Knitting Machine.** Interwoven Stocking Co. (New Brunswick, New Jersey, U.S.A.). B.P.564,189 of 11/11/1942:18/9/1944 (Conv. 19/2/1942). The invention comprises a circular knitting machine having co-axial superposed needle cylinders and needles operable in either cylinder and transferable from one cylinder to the other by selectors associated with the needles and having selector butts engageable by selector levers which are movable into and out of operative position in predetermined order by a selector pattern drum to transfer selected needles, in which separate sets of selector levers are independently controlled to maintain one set of levers inoperative while levers of another set are moved into and out of operative position, and in which means are provided for orienting the selector pattern drum to the proper position for starting each of successive articles produced on the machine and for stopping the pattern drum at predetermined points during the knitting of each article to maintain the same needle selection for a number of courses. The invention further comprises a multi-feed circular knitting machine having coaxial superposed needle cylinders, needles operable in either cylinder, sliders for operating the needles in each cylinder and selectors associated with the needles and operable by selector levers to transfer selected needles from one cylinder to the other, in which means acting on the sliders are operable to by-pass selected needles at at least one of the feeds, and in which means are provided for independently controlling separate sets of selector levers to maintain one set of levers inoperative while levers of another set are moved into and out of operative position, selector levers of one set being actuated to produce Links-Links fabric, and selector levers of another

set being individually actuated to position alternate needles in the upper cylinder during the knitting of a number of courses, and thereafter to position selected needles in the upper and lower cylinders respectively to produce rib knit fabric other than  $1 \times 1$  rib for a number of successive courses. C.

**Insulating Fabrics: Production.** D. Finlayson and H. Crawshaw. B.P. 564,192 of 19/11/1942:18/9/1944. A fabric suitable for oiling or varnishing (e.g. for use as an electrical insulating fabric) comprises in both warp and weft, yarns of great tensile strength and low extensibility and yarns of relatively low strength and high extensibility woven together in such a way that the yarns of low extensibility are not interlaced with other yarns of the same kind but depend for their maintenance in the fabric structure on the presence of the yarns of high extensibility. When a fabric of this kind is treated with an insulating varnish it is found to possess a much higher resistance to tearing than a fabric of similar weight woven from the stronger yarns alone. It is particularly convenient to employ as the stronger yarn saponified cellulose acetate yarns that have been stretched. The yarns of lower strength may be cellulose acetate yarns or other thermoplastic yarns such as polyvinyl derivative yarns. Insulating varnishes, e.g. of the type comprising a basis of a drying oil, may be applied to the fabric by any suitable means. C.

**Cut Ribbons: Production.** C. Clay & Sons Ltd., C. R. Clay and Agnes M. Heasman. B.P.564,337 of 28/6/1943:22/9/1944. For the application of the method of B.P.544,379 to the cutting of a woven fabric, such as Petersham, consisting of cellulose acetate warp and relatively heavy cotton weft, the angle between the sides of the ridge on the periphery of the cutter disc is  $35-40^\circ$ , a radius of about 0.004 in. being formed at the edge of the ridge. C.

**Hosiery Tops: Knitting.** Hemphill Co. (U.S.A.). B.P.564,391 of 8/2/1943:26/9/1944 (Conv. 9/2/1942). A method of knitting with a machine having needles and sinkers includes feeding a yarn to all of a group of needles at one feeding station, feeding a second and relatively fine yarn at a second feeding station to alternate needles of said group leaving intervening or intermediate needles unsupplied with the second yarn, and causing the said alternate needles to draw the second yarn over the nibs of sinkers. A greater tension may be applied on the second yarn than on the first yarn. A rib-like fabric is produced by feeding a yarn to all the needles at one feeding station and feeding a second and relatively fine yarn to alternate needles at a second feeding station, and adjacent to the second feeding station causing alternate needles to draw the second yarn over the nibs of alternate sinkers only and knitting relatively tight stitches with the alternate needles and c.using each alternate needle in the knitting cycle to rob from the stitch drawn by the needle in advance thereof. C.

**Accordion or Mock Rib Fabric: Knitting.** Hemphill Co. (U.S.A.). B.P. 564,397 of 30/3/1943:26/9/1944 (Conv. 2/4/1942). A method of knitting an accordion type fabric wherein at one feeding station a yarn is knitted by all needles and at a second feeding station another yarn is knitted by spaced needles only and is floated over intermediate needles, is characterised by the step of elongating floats of the second yarn by robbing material for the floats from the stitches of that second yarn. Floats of the accordion yarn are elongated by extending them while robbing material from the adjacent stitches. Sinkers or web holders may be given an additional movement for the purpose of elongating the floats of the second or accordion yarn. The sinkers may be constructed with inclined nibs. A knitting machine for carrying out this method of knitting is provided with needles and sinkers which are independently controlled. Alternate sinkers may be provided with inclined nibs and intermediate sinkers constructed to have yarn drawn in their throats. C.

**Looped Fabric Articles: Production.** Elsa Horler (Barcelona, Spain). B.P. 564,413 of 8/9/1942:27/9/1944 (Conv. 9/9/1941). An article with strong loops resembling knitted loops is formed by the interlacement of horizontal rows of loops in such a way that each single loop is interlaced with loops of the neighbouring horizontal row and also with both of the lateral loops of the same horizontal row. The formation of the rows of interlaced loops may be carried out by using an embroidery machine and replacing the frame normally used for holding the base fabric by wire or string grating, the wires or strings of which can be withdrawn from the interlaced loops on completion of the articles. The grating may be rectangular for forming a fabric resembling



that knitted on straight-bar machines, or circular when fabric resembling fabric knitted on a circular machine is desired. In forming the fabric upon a rectangular grating it is advantageous to link the various loops in one row from right to left and in the next row from left to right, firm selvages being always formed in this way. In forming fabric resembling circular knitted fabric the interlacing of the horizontal rows of loops is effected in spiral form, so that in this way seamless stockings or other tubular goods can be manufactured. Fabrics resembling plain knitted fabrics in elasticity, softness, uniformity, fineness and transparency can be produced. C.

**Knitting Machine Yarn Changing and Splicing Mechanism.** H. H. Holmes, A. H. Widdowson and Wildt & Co. Ltd. B.P.564,510 of 4/1/1943:2/10/1944. Yarn changing and splicing mechanism comprises, in combination, a number of movable yarn guides, one or more for a striping yarn or yarns, respectively, others for a main or ground yarn, and a splicing yarn, respectively, and means for automatically operating the guides interchangeably so that a striping yarn is supplied to a section of the needles while the main or ground yarn and the splicing yarn are substituted for the striping yarn and supplied to the remainder of the needles during a course or a succession of courses of knitting, periodically, and in the intervals the main or ground yarn only is supplied to the said section of the needles and both the main or ground yarn and the splicing yarn are supplied to the remainder of the needles. A knitted fabric is produced wherein there are, coursewise, adjoining sections, one consisting of horizontal striping effects composed of the main or ground yarn only with which are interspersed partial courses of a striping yarn, or yarns, respectively, and the other consisting wholly of both main yarn and splicing yarn. The invention is applicable primarily to circular knitting machines, particularly to machines for knitting seamless hosiery. C.

**Nylon: Sizing.** Lister & Co. Ltd., W. Garner, F. G. Holroyd, Allied Colloids (Bradford) Ltd., G. Langley and R. Gill. B.P.564,737 of 28/12/1942:11/10/1944. Textile materials, composed of non-cellulose synthetic linear polymers such as nylon, in loose form, as a sliver, or as yarn, or in intermediate stages of processing or in other form are treated with a mixture of wax and oil in very fine aqueous dispersion with casein; after subjecting to customary textile operations such as setting, weaving or knitting, they may then be scoured. The combined percentage of wax and oil on the sized yarn may be between 0.5 per cent. and 10 per cent., and the percentage of casein between 0.5 per cent. and 5 per cent. The oil may consist of a light mineral oil and/or non-drying vegetable oil and/or a synthetic ester. The wax may be of hydrocarbon, vegetable or animal type. Antiseptics, emulsifying agents, anti-static compounds, fatty acids, colouring matter, antioxidants and insolubilising agents for the casein may also be included. If desired, petroleum jelly may be used alone instead of the mixture of oil and wax. A suitable scouring operation may consist of a treatment for 1 hour at 70° C. with 15 per cent. soap and 5 per cent. sodium carbonate, or alternatively 0.5 per cent. caustic soda, calculated on the weight of goods (liquor/material ratio 40:1). Woven or knitted fabrics may be set by steam blowing, decatizing or calendering after sizing but before scouring. Such pre-set material may be scoured and dyed in open width or rope form without the development of crease marks or other distortion of the fabric after drying. C.

#### 4—CHEMICAL AND FINISHING PROCESSES

##### (B)—BOILING, SCOURING, DEGUMMING AND WASHING

**Knit Rayon Outerwear Fabric: Processing.** E. S. Dunlap. *Textile World*, 1944, 94, No. 6, 121. Practical hints are given on the scouring, dyeing and scrooping of rayon outerwear fabrics. For scouring, a bath containing 2 per cent. of soda ash and 1 per cent. of a synthetic detergent is recommended; the cloth is treated on a reel for about 25 minutes at 180-190° F. If much oil is present, the addition of Na metaphosphate or pyrophosphate is advisable. Dyeing may be carried out in the same machine after rinsing. The "Tube-Tex" machine is recommended for scrooping and water-repellent finishes. C.

**Nylon Fabrics: Processing.** E. I. Du Pont de Nemours & Co. *Rayon Textile Monthly*, 1944, 25, 325-327. Practical advice is given on (1) scouring, (2) dyeing (and stripping), (3) finishing and setting, and (4) cleaning of nylon fabrics or garments. (See also Section 3A, above.) C.



**Jute Incrustants: Relation to Fibre and Yarn Strength.** B. P. Ridge, A. H. Little and J. Wharton. *J. Textile Inst.*, 1944, 35, T93-116. When jute is treated with the chemicals employed in textile purification and bleaching processes the lignin, hemicellulose and other incrusting substances are attacked and to some extent removed. Removal of substantially all the lignin with retention of hemicellulose, or of hemicellulose with retention of lignin, results in low wet strength although dry strength is but little affected. Treatments that result in the partial removal of both these incrustants usually reduce both dry and wet strength, although in hot alkaline steeps such as are given in peroxide bleaching, where fibre swelling can occur and there is no pronounced removal of incrustants, dry strength may be increased above the original value owing to the closer setting of fibre on fibre that occurs as a consequence of swelling and subsequent drying. Boiling under moderate pressure with sodium hydroxide solution removes substantially all the hemicellulose but little lignin, whilst treatment with acid chlorite solutions and then neutral sulphite liquor removes the lignin but not the hemicellulose. The incrustants in jute resemble in their behaviour the starch size on a low-twisted sized cotton yarn and whilst they themselves have little strength they contribute in marked manner to the strength of the jute by cementing together the ultimate cellulose fibre bundles on which the strength fundamentally depends. In oxidation treatments commonly employed in technical bleaching they appear to have a protective action on the cellulose. Alkaline hypochlorite has mainly an oxidising, and acid hypochlorite a chlorinating action on jute, and use of the latter in conjunction with pressure boil with sodium hydroxide and a final oxidation bleach with alkaline hypochlorite promotes attack and removal of lignin and fairly readily allows pure white cellulose to be isolated. If the preliminary chlorinating treatment is not given, more drastic boiling at high pressure is necessary and more than one boil may be required. The characteristics of the jute cellulose are such as to suggest that the product can be used satisfactorily for the manufacture of viscose, cellulose compounds and white papers. The "browning" of bleached jute that occurs when this material is exposed to sunlight can be prevented only when the conditions of purification are such as to ensure that no lignin remains, and it appears that lignin itself is the product responsible for the browning effect. C.

#### (E)—DRYING AND CONDITIONING

**"Dryair" Colloidal Silica Drying Elements.** R. K. Dundas Ltd. *Engineer*, 1944, 178, 271. A brief note is given about elements for (1) storing with goods to keep them dry, (2) keeping the interior of petrol engine cylinders dry, or (3) for protecting gun barrels, that use colloidal silica as desiccating agent. This may be tinted blue (with cobalt chloride) so that approaching exhaustion is revealed by a change of colour to pink. One element is effective for a year in an ordinary storage place and may be revived by heating at 200° C. for half an hour. C.

**Drying Cylinder Condensate High-pressure Return System: Advantages.** R. Lundrigan. *Textile World*, 1944, 94, No. 7, 70-71. Brief particulars are given of some American finishing works, in which the problem of providing steam for additional drying plant has been met by the installation of jet or centrifugal pumps and auxiliary gear for returning the condensate from the drying cylinders under high pressure to the boilers. With such plant it is possible to return the condensate from steam supplied at 100 lb. per sq. in. (338° F.) at 320° F., thus preventing the usual heavy heat loss if an open system is used to return water at about 210° F. C.

**Staple Fibre: Spontaneous Inflammability.** W. Specht. *Deut. Z. gerichtl. Med.*, 1942, 36, 174, 180 (through *Chem. Zentr.*, 1943, i, 801 and *Chem. Abstr.*, 1944, 38, 3483<sup>3</sup>). Staple fibre containing 140-200 per cent. water repeatedly gave rise to fires in the drying apparatus. The temperature of the steam-heated dryers was as high as 150°. The fires are attributed to some staple fibre that adhered to the dryer outside the actual oven space. Experiments showed that staple fibre which has charred is extremely autoxidisable. Such charred staple fibre can readily ignite spontaneously under the catalytic action of rust. The possibility of spontaneous ignition by electrostatic charges is considered. C.

**(G)—BLEACHING**

**Cotton Goods: Continuous Peroxide Bleaching.** D. J. Campbell. *Amer. Dyes. Rept.*, 1944, 33, 293-298. A continuous process for the bleaching of cotton goods consists of two basic steps each involving uniform impregnation of the cloth with its own weight of treating solution, heating to a predetermined reaction temperature in a chamber wherein the surfaces of the cloth are exposed to an atmosphere of conditioned steam, and storing or ageing the heated cloth without heat loss for a period of one hour. In the treatment of goods that do not contain dyed patterns, the first step is a treatment with caustic soda, usually a 3 per cent. solution. For fabrics containing dyed patterns the first step involves treatment with 0.5 to 1.0 (usually 0.5) volume hydrogen peroxide. For the second step a 0.5-1.0 volume peroxide bath is used. The temperature of the cloth during storage should be 205-210° F. The pH of the impregnation baths should be controlled in the range 10.4-10.8, using sodium silicate as stabilizing and buffering agent. Preliminary singeing, desizing and mercerising treatments may be incorporated in the process. Suitable impregnating apparatus and heating and storage chambers are briefly described. Operating speeds of up to 190 yards per minute have been reached. It is claimed that the steam consumption of this process is less than that of other bleaching processes, and that the total cost of chemicals used is lower than in any other method of peroxide bleaching and is well in line with the lowest figures for hypochlorite bleaching. C.

**Hydrogen Peroxide: Use as Antichlor.** B. Walther. *Wäscherci-Ber.*, 1942, 10, 67-71 (through *Chem. Zentr.*, 1943, i, 1013-1014 and *Chem. Abstr.*, 1944, 38, 3846<sup>n</sup>). Instead of sodium thiosulphate to counteract excess chlorine after bleaching, it is proposed to use hydrogen peroxide, which does not affect the copper washing drum and is more economical. Furthermore, the hydrogen peroxide has the advantage that on decomposition of chlorine lye, which often occurs, there remains a large excess of hydrogen peroxide after the antichlor action, and this acts as an after-bleach. Experiments with cotton and linen indicate that the fabrics are least affected by bleaching if hydrogen peroxide is used as antichlor. C.

**(H)—MERCERISING**

**Mercerisation: History.** W. Döhle. *Textilberichte*, 1943, 24, 430-434 (through *Chem. Abstr.*, 1944, 38, 3483<sup>2</sup>). A discussion of the discovery of mercerisation, chemical phenomena, theoretical basis, physical changes of the fibre, determination of the degree of mercerisation and future outlook. C.

**(I)—DYEING**

**Dead Cotton: Dyeing.** Marcel Pagerie. *Rayon Textile Monthly*, 1944, 25, 286. The author discusses the origin of dead cotton and its effects in dyeing. A recommended dyeing procedure for covering dead cotton is: Prepare the dye-bath with wetting agent as usual. Start dyeing at 120° F. with all the required dye present. Raise to the boil during the next half an hour and keep at the boil for another half an hour. Shut off the steam and add the required amount of salt. Allow to cool. Suitable dyes are mentioned. C.

**Vat Dye Oxidising Agents: Selection.** *Textile World*, 1944, 94, No. 6, 117. Recipes are given for vat dye oxidising baths containing (1) Na dichromate, (2) Na perborate, (3) hydrogen peroxide, (4) sodium chlorite and (5) ammonium persulphate. Nos. 1, 2, 3 and 5 are acidified with acetic acid and No. 4 has Na bicarbonate. No. 1 has the most rapid action and No. 5 the slowest; (1) is applied at 120-212° F., but (5) at 80° F. Formation of oxycellulose is deemed to be possible with all except No. 1 if control is not rigid. No. 1 can be varied over fairly wide ranges of temperature and concentration without much effect on the shade of the dyeing, but the other agents require closer control. All the agents give the same results with regard to the fastness of the dyeings, if properly applied. Dichromate is much more difficult than the other agents to rinse out of the cloth. C.

**Wollstra and Staple Fibre-Cotton Mixtures: Dyeing.** F. Richards. *Kunstseide u. Zellwolle*, 1942, 24, 614-616 (through *Chem. Zentr.*, 1943, i, 1220 and *Chem. Abstr.*, 1944, 38, 3479<sup>3</sup>). The treatment is similar to dyeing of part-woollen materials. Treatment before dyeing is accomplished in a hot bath with soap, Igepon T and Laventin KB. Size containing starch is treated with biolase,

Aktivin or similar product. In the presence of paraffin, montan wax or tallow, the size may be removed with Asordin. Substantive dyes are sufficient for most dyeing operations. For greater fastness Indanthrene or Naphthol-AS combinations may be employed. For light and medium tints many indigo salts may be applied by the slop-padding process, giving beautiful uniform shades. Para dyes developed with Nitrazol CF give good shades on cotton and viscose. For light tints it is best to use unmercerised cotton. Dyeing at various temperatures, with or without salt, is discussed. Indanthrene dyes are used on sensitive fabrics on the tension-free special jigger for rayon dyeing or drum. Improvement in uniformity of tint between cotton and rayon is obtained by slop-padding. Directions are given. Dyeing of dense fabrics is discussed. Naphthol AS-RR with mixtures of rayon and cotton penetrates deeper at higher temperatures than in the cold. C.

**Anthrasol Blue IBC: Piece Dyeing Difficulties.** W. Mitfessel. *Textilberichte*, 1942, 23, 492-493 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 202-203). This dye is susceptible to oxidation and has a very low substantivity, particularly when used on spun rayon and delustrated rayon and in the presence of residual nitrous acid. A corrective is 1.5-5.0 g./l. of Dekol applied on the jigger and/or added to the dyeing or developing bath. Irregular dyeing, producing moiré effects, sometimes results especially in the presence of copper compounds. Peregol O is frequently a satisfactory corrective for this, but may fail if decorative effect threads dyed with an indanthrene dye are present. In such cases the most effective method is to ensure thorough and uniform penetration of the goods by the solution in the dye bath (special plant described). When dyeing foulards by the slop-pad method, high roll pressure and tensions should be avoided; the goods should hang as loosely as possible. C.

**Cellulose Fibres: Dyeing.** — Hajo. *Textilberichte*, 1943, 24, 511-513 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 202). Factors affecting the uniformity of dyeing of cellulose fibres include variations in and too high a temperature in the dye bath, inadequate circulation of liquor in the bath, presence of fibre mixtures (e.g. under equal dyeing conditions Egyptian cotton acquires a stronger shade than American cotton), and inequalities produced in a pre-treatment process (e.g., bleaching, oiling, scouring, etc.) or in washing out the reagent after such treatment. In particular, hydrochloric acid formed from bleaching powder residues may attack the cellulose which then has a greater affinity for basic dyes and a lower affinity for direct dyes than has the normal fibre; oxycellulose behaves similarly. Mercerising may set up unequal tensions in the web which affect the uniformity of dyeing, and unequal distributions of dressings and of soap residues (e.g. precipitated by hard water or adsorbed on the fibre during too prolonged an interval between scouring and rinsing) act similarly. Imperfect fibres (e.g. "dead" cotton, or sulphur inclusions in viscose rayon) may produce patchy results, and a dyed cloth which appears satisfactory in one type of light may appear mottled in another. With cotton, the greater the fibre-dye affinity, the greater is the tendency to non-uniformity, and vice versa. C.

**Insoluble Azo Dyes: Fixation in a Single Operation.** A. Wolff. *Teintex*, 1942, 7, 247-255 (through *Chem. Zentr.*, 1943, i, 1418 and *Chem. Abstr.*, 1944, 38, 3844<sup>2</sup>). A discussion, based on patents, of (1) mixtures of naphthazoles with stabilized and passive water-soluble diazo components that liberate the active diazo compound on the fibre and can be coupled with naphthazole, (2) mixtures of naphthazoles and water-soluble fast bases which when treated with an acid liberate the base on the fibre (the bases are diazotised by sodium nitrite contained in the dye and couple with the naphthazole), (3) temporary solubilising of the dye and rendering it again insoluble on the fibre. C.

**Spun Rayon Fabrics: Dyeing.** L. Bonnet. *Monit. Maille*, 1942, 52, No. 734, 10-11 (through *Chem. Zentr.*, 1943, i, 1108 and *Chem. Abstr.*, 1944, 38, 3844<sup>1</sup>). The goods should be carefully cleaned by the use of Igepon, Igepal or fatty alcohol sulphonates, bleached with weak hypochlorite solutions or hydrogen peroxide, and dyed with Indigosols, Anthrasols or Hydron blue with the simultaneous use of the wetting agents Peregol OK or Igepon T. Piece goods are dyed best with vat dyes on the padding machine according to the pigment process. Sulphur dyes are employed either as Immedial-leuco dyes or with reduced Rongalite C. In all cases those dyes should be preferred which dye cotton and rayon staple equally well. C.

**Diphenylbenzene Derivative Substantive Azo Dyes: Production.** C. F. H. Allen and F. P. Pingert. *J. Org. Chem.*, 1944, 9, 50-54 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 199). Technical *o*-diphenylbenzene is transformed into the 4:4'-diamino derivative, which after tetrazotisation couples very slowly with 2 mols. of a naphthol unless the solution is strongly alkaline, thus facilitating the isolation of monoazo dyes which do not colour cotton but dye wool from an acid bath. Addition of the tetrazo solution to a strongly alkaline solution of 2 mols. of H-acid yields a substantive dye. *m*-Di-*p*-nitrophenylbenzene is readily reduced ( $H_2$ , Raney Ni) to the diamino derivative, which gives a substantive dye when tetrazotised and coupled with H-acid. *p*-Di-*p*-nitrophenylbenzene is slowly reduced in dioxan at 110° and gives a substantive dye when tetrazotised and coupled with H-acid. It is suggested that a cross-conjugated system of multiple linkings and particle size contribute to substantivity. C.

**Indanthrone and Indigo: Structure.** R. Gill and H. I. Stonehill. *J. Soc. Dyers & Col.*, 1944, 60, 183-186. It is suggested that indigo, indanthrone, and certain of their derivatives are resonance hybrids of a number of contributing forms, as is generally the case with dyes, and that the resultant structure is a hydrogen-bonded type. Indications are given of the differences between this structure and the quinonoid polar form previously advanced and of the advantages offered by the former both from the viewpoint of theoretical organic chemistry and in the interpretation of (1) the colour of indigo in various solvents, (2) the lack of pronounced colour change in the normal vatting of indanthrone and some of its derivatives, (3) the necessity for the reduction of only two of the four quinonoid oxygen atoms in the normal vatting of indanthrone, (4) the absence of semiquinone formation in indanthrone, (5) abnormally large differences between the standard redox potentials of the first and second leuco-compounds of indanthrone, and (6) the differences between indanthrone and its N-methyl derivative. C.

**Dyed Canvas: Resistance to Atmospheric Conditions.** F. I. Sadov. *Tekstil. Prom.*, 1944, 4, No. 1, 15-17 (through *Chem. Abstr.*, 1944, 38, 3845<sup>5</sup>). Various treated samples of canvas were tested for resistance to light, to cold water, to washing in hot water, to perspiration, to rubbing and to atmospheric conditions. Insolation destroys cotton web rapidly. A fabric prepared for dyeing (sized and washed) lost 37.5 per cent. of its strength in 2 months and 41 per cent. in 4 months exposure. Fabrics dyed with direct dyes were somewhat more resistant to insolation than undyed fabrics. After-treatment with metal salts considerably increases this resistance. After-treatment with copper and chromium salts or with copper sulphate alone, greatly improves the light fastness as well as other properties of fabrics dyed with direct dyes. After-treatment with a waterproofing emulsion and aluminium acetate did not affect any of the other properties. Best results were obtained with a specimen dyed with (for 142 kg. of fabric): Direct Brown K 150, Direct Blue K 280, Direct Yellow Z 1440, sodium chloride 4000, sodium phosphate 2000 g. and water 200 l. After dyeing, the fabric was treated at 95-98° in potassium dichromate 2200, copper sulphate 2000 g., acetic acid (30 per cent.) 3 and water 150 l. After washing, the fabric was waterproofed and treated with a solution of aluminium acetate. C.

**Dyed Cotton: Light Fastness; Effect of pH.** C. A. Seibert and C. A. Sylvester. *Amer. Dyes. Rept.*, 1944, 33, 311-312. Tests were made on samples of cotton cloth which had been dyed with various types of dyes by the usual methods and given neutral, mild acid and mild alkaline finishing treatments. It was found that the light fastness of samples dyed with many direct, developed and sulphur dyes was definitely inferior when the cloth pH was 3.5 compared with the fastness at a cloth pH of about 7. Cotton coloured with azoic and vat dyes exhibited only minor differences under these conditions. At a pH between 8.5 and 9.5 the fastness of cotton dyed with direct and developed dyes was slightly superior or slightly inferior to that at or below pH 7 according to the particular dye used. With variations in pH between 7 and 9.5, cotton dyed with azoic and sulphur dyes exhibited only minor differences in light fastness, except in the case of sulphur blacks which were consistently superior at the higher pH values. At the higher pH values, cotton dyed with vat dyes was outstandingly inferior to the cotton at or below pH 7. Retention by vat dyed cloth of a small quantity of a mildly alkaline soap was sufficient to

reduce appreciably the light fastness of some of the dyes. Improvements could be effected, even after storing for some time, by rinsing in water containing a small quantity of acetic acid. A few experiments indicated that the presence of 0.5 per cent. of sodium chloride or acetate in the cloth did not influence the light fastness of the vat dyes. A convenient method for the determination of the pH of cloth is described and data are given showing the pH values of vat dyed cloth after rinsing, soap and other treatments. C.

**Vat Dyes and their Uses.** E. Greenhalgh. *Canadian Text. J.*, 1944, 61, No. 14, 35-36, No. 16, 38, 51. After a brief survey of the historical development of the vat colours, the constitution and characteristics are described of the indigoid and Indanthrene types, and details given of their application to fabrics and yarns, including a note on the pigment padding process. Stress is laid on the valuable fastness properties of the vat dyes. W.

**Theory of Dyeing. XII. Absorption by Wool of Acid Dyes with Different Numbers of Sulpho Groups.** A. E. Porai-Koshits, E. A. Veller and N. V. Sokolova. *J. Appl. Chem. (U.S.S.R.)*, 1943, 16, 28-35 (English summary) (through *Chem. Abs.*, 1944, 38, 3131). Three dyes (Acid Red Zh, Acid Red S and Acid Orange Light-stable) of similar structure, but varying in number and positions of the acid groups, were studied in respect to absorption on wool. Dyed in presence of sulphuric acid at pH 2.2-5, the same saturation limit of 0.8 mg. equivs. per g. was found as in previous work (these *Abs.*, 1940, A495) as the maximum amount of acid dyes chemically absorbable by wool. At pH 1.5, or less, a slight increase of absorption was found which may be due to partial hydrolysis of wool keratins. Greater absorption was noted for wool washed by organic solvents than for that washed only with ammonium carbonate. Dyeing in presence of hydrochloric acid showed somewhat higher absorption than in presence of sulphuric acid. W.

#### (J)—PRINTING

**Luminescent Pigments: Application.** *Textile World*, 1944, 94, No. 6, 91. Hints are given of the possible uses of fluorescent and phosphorescent pigments, in suitable vehicles, for decorating textiles. These materials are now produced by the ton at about 0.90-2.50 dollars per lb., but more than 90 per cent. of the output is consumed for non-textile, military purposes. The fluorescent pigments are based on Zn and Cd sulphides, and the phosphorescent ones on crystalline forms of Zn, Cd, Sr and Ca sulphides. Suitable vehicles are methacrylate and vinyl plastics. C.

**Luminescent Pigments: Application in Textiles.** M. A. Heikkilä. *Rayon Textile Monthly*, 1944, 25, 296, 345. A brief review is given of fluorescent and phosphorescent pigments and their probable post-war applications in coated and printed fabrics. A present major application is in phosphorescent adhesive tape which is used in all ships of 3,000 tons or more to supply directional markings in the event of power failure. C.

**Rayon Velvet: Printing.** *Rayon Textile Monthly*, 1944, 25, 294-295. Practical hints are given on the preparation for and printing of rayon velvets, especially those with cellulose acetate pile. C.

**Cellulose Fabrics: Printing.** A. Wolff. *Teintex*, 1942, 7, 284-285 (through *Chem. Zentr.*, 1943, 1, 1108 and *Chem. Abstr.*, 1944, 38, 3845<sup>b</sup>). The use of the following is discussed: Indigosols and Rapidogens, insoluble azo dyes that can be developed and fixed with and without acid (Rapidogens, Rapid fast dyes and Rapidazols), and water-soluble dyes that are made insoluble in the fibre (Neocoton dyes, pigment dyes like Aridyces and Impralac). C.

**Lining Fabrics: Printing.** *Textile Recorder*, 1944, 62, September, 63-67. A general description of singeing, bleaching, dyeing, printing and finishing for the production of lining fabrics. C.

**Rayon Fabrics: Printing.** T. Fischer. *Textilberichte*, 1942, 23, 493-495 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 203). Special problems arising in the printing of rayon as distinct from cotton and spun rayon products are dealt with by the new types of German machines described. Pre-treatment is important (e.g. with lactic acid or glycerol); Ramasit in particular makes the web slightly water-repellent and gives very sharp printing effects. Glazing between rollers is also effective, but is apt to damage rayon goods if overdone. Synthetic rubber printing rollers have given excellent results. Paste formulae

recommended contain Anthrasol Blue IBC 15, in the presence of sodium chlorate 2, tragacanth-starch 200, and ammonium metavanadate about 55 g./l.; or Rapidogen Blue B 15, in the presence of urea 25, caustic soda lye 25, ethyl alcohol 25 and tragacanth-starch 200 g./l. A 15-20 per cent. increase in production is obtainable by the use of the automatic paste feed described. The solution is contained in a closed airtight reservoir, and the outlet from a pipe in the bottom dips below the level of the solution in the feeding trough; the latter level is thus automatically maintained constant. C.

#### (K)—FINISHING

**Plastic Coating Applying Machines: Types and Limitations.** J. B. Cleaveland. *Textile World*, 1944, 94, No. 3, 74-76; No. 5, 90-91; No. 6, 107, 111; No. 7, 81-85. An illustrated description is given of knife coating, knife spreading, knife blanket, knife roller, reverse roller, extrusion and spraying types of machines for applying plastic coatings and precautions to be observed when using them are discussed. C.

**Superheated Water Systems: Application in Finishing Plant.** P. L. Geiringer. *Textile World*, 1944, 94, No. 6, 104-105. The author stresses the advantages of heating by superheated water, conveyed in relatively narrow pipes, for various operations in dyeing, printing, finishing, humidification, etc. Even the steam cylinders of a drying machine can be conveniently supplied from a local steam-raising unit fed by the superheated water. It is economical to set the boiler plant for about 400 lb. per sq. in. pressure, and 75-80 lb. back-pressure, thus providing water at 310° F. or more. C.

**Cerex Resins: Properties and Uses.** C. L. Jones. *Modern Plastics*, 1944, 21, No. 11, 83-84, 166, 168. The causes of the poor dimensional stability of thermoplastic resins are discussed and the advantages of Cerex resins are pointed out. The Cerex resins have heat distortion points (American Society for Testing Materials) ranging from 195 to 300° F., values that actually overlap similar figures for many thermosetting moulding compounds. Early developmental work has been confined to the X-214 brand which has a heat distortion point of approximately 225° F. Tables are given showing the thermal, mechanical and electrical characteristics of this resin and of polystyrene, and the results of treatment for 48 hours with boiling water of compression-moulded disks of general-purpose phenolic and urea resins, and Cerex formulation X-214. The mechanical properties of the Cerex resin are fully equivalent, if not superior, to those of polystyrene, and the dielectric strength is superior to those of the electrical grades of phenolic moulding compounds. The A.S.T.M. arc resistance is similar to that of polystyrene, in the neighbourhood of 70 sec. This new resin retains the chemical resistance of polystyrene, and moulded parts can be boiled in battery acid for a sustained period with no appreciable effect. It is soluble in aromatic and chlorinated hydrocarbons but insoluble in aliphatic hydrocarbons. War-time applications and projected post-war uses are indicated. Moulding of Cerex resins is briefly discussed. C.

**Softening Agents: Effect on Fabrics.** S. Ueno. *J. Soc. Chem. Ind. Japan*, 1941, 44, Suppl. Binding 101-103 (through *Chem. Zentr.*, 1943, i, 1016 and *Chem. Abstr.*, 1944, 38, 3482<sup>n</sup>). Lauric, myristic, palmitic, stearic and oleic acids and paraffins produced a stiffening instead of a softening effect. Peanut oil, fat acid esters, cholesterol, turpentine, eugenol, menthol, etc., showed slight softening effects. An excellent softener is cetyl ethyl ether, prepared from cetyl iodide and sodium ethylate. C.

**Starch Finishes: Characteristics.** *Rayon Textile Monthly*, 1944, 25, 291-293. A broad review is given of the colloid properties of the common starches (gelatinization, retrogradation, viscosity, effects of salts) that govern their behaviour in finishing. C.

**Cotton Fabrics: Shrink Finishing.** F. R. Redman. *Textile World*, 1944, 94, No. 7, 91. A brief report is given about a shrink-proofing process in which the cloth is advanced along a conveyor in a rumpled, loose manner, is exposed to steam spray, and finally dried. Reports of laundering tests on knit cotton under-shirts are recorded. The unfinished cloth shrank about 14 per cent. in one wash and nearly 20 per cent. in 20 washes, but the values for the finished cloth were 3.4 and 6.5 per cent. The finished cloth reached fairly constant

dimensions after very few washes. The U.S. Underwear Institute has appointed a committee to investigate the machine. C.

**Gelatin: Use in Finishing.** H. J. Henk. *Gelatine, Leim, Klebstoffe*, 1942, 10, 127-129 (through *Chem. Zentr.*, 1943, i, 1836 and *Chem. Abstr.*, 1944, 38, 3846<sup>5</sup>). A discussion of the use of gelatin as protective colloid in boiling out cotton, as dispersing agent for lime soap, as stabilizer for olein emulsifying agents and for hydrogen peroxide baths, as dyeing assistant, as reserve assistant for indigosols, as sizing medium, and for protecting wool during chlorination and against proteolytic damage. C.

**Seaweed Powder: Use for Sizing.** P. Islent'ev. *Tekstil. Prom.*, 1944, 4, No. 2/3, 15-18 (through *Chem. Abstr.*, 1944, 38, 3846<sup>6</sup>). Sodium alginate is suitable for sizing and finishing textiles and as a thickener for basic dyes. Because the cost of extraction is high, experiments were made on the use of finely ground, whole seaweed, containing moisture 13.8, ash 27.4, water-insolubles at 40° 56.9 per cent.; the insoluble matter includes 26.8 per cent. of alginic acid. Details are given of a method of determining alginic acid. Na, K, NH<sub>4</sub>, Li and Mg alginate solutions are 10-12 times more viscous than similar concentrations of starch. Size is best prepared from powdered seaweed not less than 4 per cent., and sodium carbonate 20 per cent. of the weight of air-dry powder, by heating at 60-65° for 45-60 min. For sizing textiles powdered seaweed can be used alone or mixed with corn, wheat or rye flour. C.

**Starch: Chemistry and Application.** *Textile Recorder*, 1944, 61, Jan., 65-67, 56. In continuation of previous articles, the writer describes the processes of starch mangling, back-filling and drying, with particular reference to recipes and machines. C.

**Oilcloth: Development.** F. J. Tuttle. *Textile Research*, 1944, 14, 228-232. A review of the development of oilcloth, including oiled silk, cotton and other fabrics, tarpaulins, floor coverings and American or leather cloth. C.

**Complex Organic Compounds in the Textile Industry.** *Dyer*, 1943, 90, 127-128, 167-169, 201-203, 247-251, 277-279, 317-318, 359-360, 401-403, 441-443, 481-484; 1944, 91, 15-16, 97-99, 183-185, 202. The constitution, textile uses and evaluation are described of soaps (including those for special purposes, e.g. wool scouring and milling soaps, and solvent, ethanalamine and glycol soaps), non-detergent soaps (e.g. aluminium soaps for waterproofing, copper soaps for rotproofing and other metallic soaps for various purposes), sulphonated oils and sulphonated fatty alcohols, surface-active agents, quaternary ammonium compounds, dye levelling agents and emulsifying agents. The textile uses are also given of glue, casein, lecithin and other protein auxiliaries. The characteristics of certain surface-active agents and the constitution of wetting agents are discussed in detail. W.

#### (L)—PROOFING

**Textile Materials: Waterproofing.** E. Dutoit. *Teintex*, 1942, 7, 82-84 (through *Chem. Zentr.*, 1943, i, 1016 and *Chem. Abstr.*, 1944, 38, 3483<sup>4</sup>). The material is impregnated at pH approximately 4.5 with a solution of animal or vegetable albumin, fixed by steaming or by brief treatment with hot water, and soaped hot at pH 7.5. The soap bath can be replaced by an emulsion of a higher fat acid; a mixture of oleic and stearic acids is most suitable. It is advantageous to add some wax to the fat acid emulsion. C.

**Fabrics: Waterproofing.** L. Bonnet. *Teintex*, 1942, 7, 285-290 (through *Chem. Zentr.*, 1943, i, 1433 and *Chem. Abstr.*, 1944, 38, 3847<sup>2</sup>). A general discussion of the porous waterproofing finish of textiles. Protective layers on fibres are produced by double-bath treatments with aluminium acetate and soap or with alkaline alginates and by various single-bath treatments. The following new commercial products are discussed: Tylose, Apermene N (Francolor), Ramasit I and K conc. (I. G.), Praedigen T (Roehme), and Waxol (I.C.I.). The fibre can be waterproofed by changing its surface, as by esterification and etherification. Applications of Velan PF and of Persistol (I. G.) are described. C.

**Ferrous Sulphate: Use in Waterproofing.** O. A. Samsonova. *Tekstil. Prom.*, 1944, 4, No. 1, 20-21 (through *Chem. Abstr.*, 1944, 38, 3846<sup>6</sup>). Waterproofing with ferrous sulphate requires an oxidation treatment. Oxidation has the disadvantage of causing a yellowing of the fabric, but it increases water resistance



and fastness to sunlight. Oxidation is best effected in a solution of potassium dichromate. If pure ferrous sulphate is used, the solution of dichromate is acidified with acetic acid. If the ferrous sulphate contains any ferric iron, sulphuric acid should be used in the oxidising solution. In this case the fabric must be thoroughly neutralised. Details of the process are given. C.

**Mercury: Determination in Mildew-proofed Textiles.** D. A. Shiraeff. *Amer. Dyes. Rept.*, 1944, 33, 310 and 315. For the determination of mercury in textile materials which have been mildew-proofed with organo-mercuric compounds, a sample (0.25 g.), shredded or cut into small pieces, is left in 20 c.c. of ether saturated with hydrochloric acid for 20-30 min. with occasional shaking, the ether is evaporated and 5 c.c. of chloroform and 10 c.c. of distilled water are added. The mixture is then titrated with a solution of dithizone in chloroform until the colour of the chloroform layer changes from orange to a slightly greenish dark brown. The dithizone solution is standardised by a similar titration with a mercuric chloride solution of known composition. The method is reliable and rapid. C.

#### PATENTS

**Polyvinyl Esters: Saponification.** R. P. Roberts, E. B. Johnson and H. H. Taylor. B.P.563,991 of 21/11/1941:7/9/1944. A process for the production of polyvinyl compounds containing hydroxyl groups comprises saponifying a polyvinyl ester in a solution consisting of an alkali, a lower aliphatic alcohol, and water in amount 1-10 per cent. of the total weight of liquid, the amount of alkali being substantially less than is equivalent to the ester group to be displaced. Products in which the final proportion of hydroxyl group to ester group is such as to impart to the compound a degree of solubility in water are particularly valuable for the manufacture of yarns, fabrics, etc., which are soluble or dispersible in water. For this purpose the amount of water in the saponification medium should be such as to give an ester content of 30 per cent. or lower, and preferably between 2 and 12 per cent. C.

**Tetrakisazo Dyes: Production.** Society of Chemical Industry in Basle. B.I.P. 564,024 of 2/9/1942:11/9/1944 (Conv. 2/9/1941 and 17/7/1942). Tetra-kisazo dyes are made by tetrazotising and coupling with 2 molecules of 1:3-dihydroxybenzene or 1-amino-3-hydroxybenzene, a diaminodisazo dye of given general formula. The diamino compound is advantageously prepared by coupling in an alkaline medium a diazo compound of the benzene or naphthalene series which contains in meta- or para-position to the diazo group a group capable of conversion into an amino group, e.g. a nitro group or an acidylamino group, and may also contain other substituents, with an amino-naphthalenesulphonic acid of given general formula, diazotising the resulting monoazo dye, coupling it with a so-called middle component of the naphthalene series and finally converting into an amino group the group in the initial component capable of such conversion. The tetrakisazo dyes have a pronounced affinity for natural and regenerated cellulose fibres. The shades obtained vary from red-violet to grey-violet, dark brown and olive green. The shades are not substantially altered by after-treatment with formaldehyde, but may be altered to a greater extent when developed with diazotised *p*-nitraniline. C.

**Shock-absorbing or Cushioning Material: Production.** Lister and Co. Ltd. and W. Garner. B.P.564,026 of 2/11/1942:11/9/1944. A shock-absorbing or cushioning material comprises three or more textile fabrics held or secured in superposition and at least two layers of resiliently flexible elements respectively connecting adjacent fabrics by being woven into one of the latter and by being secured by adhesive to the other, these resiliently flexible elements providing "legs" between the adjacent fabrics which, due to their length, their substantial inclination, or approach to normality, to the surfaces of the fabrics and their resistance to collapse, are capable of holding the fabrics spaced apart at least 0.1 in. or, if external compression has been applied, of restoring them to such spacing apart when the compression is released. The material may be produced by securing together two or more pile fabrics by adhesive between the tips of the pile on one fabric and the backing of the next fibre. Alternatively two or more double pile fabrics may be superposed with the interposition of a layer of cloth secured by adhesive to the pile contiguous to it on both sides. A layer of cloth is secured by adhesive to the exposed pile or piles of the outer fabric or fabrics of the composite structure. The resilient connecting elements may be dis-



posed in groups or strips separated by gaps and a honeycomb structure may be produced. With mohair yarn connecting elements satisfactory results may be obtained with "leg" densities between 250 and 2,000 per square inch, and fabric spacings of 0.1 to 0.4 in. Materials made from various other types of fibres, e.g. wool, cotton, rayon, kapok, glass and asbestos, may be used. C.

**Plastic Bead Decorated Fabrics: Production.** H. Freiberg. B.P.564,104 of 12/2/1943:13/9/1944. A process for the decoration of a fabric to simulate beadwork comprises applying a mixture of a heat-hardenable urea-formaldehyde resin, a hardener and, if desired, a pigment, the mixture being extruded in single drops on to the surface, and heating the material in an oven to about 120° F. so as to convert the composition to the hardened and insoluble condition. C.

**Differentially Dyed Fabrics: Production.** Courtaulds Ltd., C. M. Whittaker, H. A. Thomas, C. C. Wilcock and C. P. Tattersfield. B.P.564,131 of 10/3/1943:14/9/1944. A process for the production of differential dyeing effects comprises impregnating the fabric with a solution or suspension of a non-volatile dye or of resin-forming compounds which are capable of altering the dyeing properties of the material of the fabric, and evaporating the liquid more rapidly from one portion of the fabric than elsewhere. With a dye, the two portions of the fabric are thereby differently coloured, and with resin-forming compounds, different colour effects are obtained on subsequently heating the fabric to effect condensation and then dyeing. If hot or cold air is blown on to one side of the impregnated fabric the two sides will or can be differently coloured. For the production of a differential effect on one side of the fabric, stencils, templates or other suitable means may be used for localising the evaporation. The resin-forming compounds may be cyanamide and formaldehyde, and the impregnating liquid may also contain an intensifier such as ammonium thiocyanate. C.

**Tetrakisazo Dyes: Production.** Society of Chemical Industry in Basle. B.P.564,258 of 2/9/1942:20/9/1944. Tetrakisazo dyes are made by tetrazotising a diamino-disazo dye of given general formula and coupling the tetrazotised dye with 2 mols of resorcinol or with 2 mols of 1-amino-3-hydroxybenzene. The parent diaminodisazo dye may advantageously be made by combining a diazotised aminoazo dye of the general formula  $t \cdot R_1N:N \cdot R_2 \cdot NH_2$ , in which  $t$  stands for a nitro group or an acidylamino group, in an alkaline medium with an aminohydroxynaphthalene sulphonic acid, and then converting the nitro group or acidyl amino group in the resulting dye into an amino group by reduction or saponification. The tetrakisazo dyes have a pronounced affinity for natural and regenerated cellulose fibres. The shades obtained vary from red or red-violet to dark blue-green, olive green, black and brown. The shades are not substantially altered by after-treatment with formaldehyde, but may be altered to a greater extent by development with diazotised *p*-nitraniline. C.

**Textile Fabric Petrol Tanks: Production.** Courtaulds Ltd., C. Diamond and A. Hill. B.P.564,265 of 4/1/1943:20/9/1944. Receptacles for organic liquids, and in particular petrol tanks, can be manufactured by completely forming the receptacle from a composition consisting of a cellulose ester, e.g. cellulose acetate, together with a plasticiser, and then saponifying the inside surface of the receptacle to such a degree that the walls of the receptacle are capable both of resisting swelling and also removal of the plasticiser therefrom when in contact with the organic liquid. The cellulose ester sheet may have a backing of fabric, e.g. of cotton, rayon, or wire, and/or may be surrounded with self-sealing layers of bullet-proofing materials. C.

**Wetting Agent: Preparation.** A. E. Everest, J. A. Wallwork and M. Briscoe. B.P.564,359 of 18/1/1943:25/9/1944. A wetting agent, which is a clear liquid miscible with mineral oils, is prepared by treating a mixture of one or more cyclo-aliphatic amine salts of sulphonated or sulphated aliphatic primary, secondary or tertiary alcohols containing at least 8C atoms, the corresponding cyclo-aliphatic amine sulphate, and one or more organic solvents in which the salts are soluble, with an inorganic salt, e.g. common salt, if necessary with the addition of water, and separating the clear oily layer. The salts are preferably the cyclo-aliphatic amine salts of sulphonated or sulphated lauryl alcohol. Such compositions are suitable for use either as such or when mixed with a mineral or coal tar oil for wetting out and penetrating with oil materials

saturated with water, such as wet paper, leather, textile fibres, pigments, lakes, mineral and vegetable matter, and increasing the spreading power of oil on water or wet surfaces. C.

**Laminated Fabric: Production.** British Celanese Ltd. B.P.564,364 of 24/2/1943:25/9/1944 (Conv. 25/2/1942). In a laminated fabric comprising an assembly of three fabric layers bonded together face to face by means of a thermoplastic film-forming material contained in at least one of them, the inner layer of the assembly is a thermoplastic fabric coated on one face with a thermoplastic film and both outer fabric layers of the assembly have a water-repellent coating. Preferably, the two outer fabric layers are provided by a single sheet of fabric folded to enclose the inner layer of fabric. Preferably, the outer fabric is made wholly or in part of yarns of a thermoplastic material such as cellulose acetate or other organic derivative of cellulose. Laminated fabrics of the type described are suitable for sweat-bands for hats. C.

**Factice and Gelled Rape Oil: Application in Waterproofing.** Ioco Rubber & Waterproofing Co. Ltd., A. Ryan and G. Cameron. B.P.564,422 of 1/3/1943:27/9/1944. A method of waterproofing fabrics comprises applying thereto a composition consisting essentially of a mixture of gelled rape oil and white factice, and hot curing. The method is equally applicable to the production of single-proof or double-proof fabrics. The fabric may be given a preliminary coating to promote adhesion of the main coat and to prevent "striking" through open texture fabrics. A sticking coat may be applied to promote adhesion when the fabric is doubled in the production of double-proof fabrics. For single-proof fabrics, the sticking coat is omitted and the fabric given any desired surface finishing treatment. The main coat is preferably prepared from a mixture of gelled rape oil, white factice, stearine pitch, whiting, zinc oxide, sulphur and an accelerator (tetra-ethylthiuram disulphide), the mixture being worked into spreading consistency with naphtha. The preliminary coat is preferably prepared from a mixture of gelled rape oil, white factice, zinc oxide, sulphur and accelerator, the mixture being worked into spreading consistency with naphtha. The sticking coat is preferably prepared from a mixture of gelled rape oil, dark factice, stearine pitch, bitumen "A" (asphaltic bitumen), china clay, vegetable black, zinc oxide, sulphur, accelerator (zinc iso-propyl xanthate) and stearic acid, the mixture being worked into spreading consistency with naphtha. C.

**Printing Blanket Washing Apparatus.** A. Abbey (Dewey and Almy Chemical Co., Cambridge, U.S.A.). B.P.564,565 of 28/7/1943:3/10/1944. A process of removing colour from the surface of a textile printing blanket in a printing machine having two blanket washing stations separated by the outward run of the blanket includes the steps of mechanically transferring a part of the soft colour to a metallic surface, breaking up the film of colour adhering to the blanket by wet-brushing the film, flooding the remaining colour with a swelling agent and diluent, maintaining the diluent in contact with the colour and blanket during the outward run of the blanket, and finally removing both diluent and colour from the blanket before it is dried. The machine is provided with blanket washing and colour diluting means located adjacent to the printing machine comprising a colour transfer roll which contacts with and removes colour from the blanket surface, means for removing colour from the transfer roll, brushing means capable of scrubbing the blanket surface, and means for supplying and maintaining a sheet of water on the blanket during its outward run to the second washing station. C.

**Printing Backing Surface Protective Coating: Application.** A. Abbey (Dewey and Almy Chemical Co., Cambridge, U.S.A.). B.P.564,566 of 28/7/1943:3/10/1944. In a backing-surface printing process for printing on fabric, porous paper or other porous web, there is applied to the supporting surface (impression surface), which may be a flexible blanket or draw sheet, a temporary continuous coating which receives the surplus ink passing through the fabric or porous web, and which coating is removed periodically and immediately replaced by a fresh coating. Ordinarily, but not necessarily, the coating is replaced after each impression. The coating composition is a material which can be applied in liquid or plastic form to the supporting surface, which will dry or harden quickly, and which will form a continuous surface so that surplus ink will not penetrate to the supporting surface and which material can

be removed easily after printing. The coating composition may, for example, be an aqueous suspension of bentonite and a rubber-loading or paper coating clay, or a mixture of ammonium alginate, whiting and water. C.

**Textile Materials: Fire-proofing.** Geigy Colour Co. Ltd. and C. Hobday. B.P.564,573 of 13/8/1942:4/10/1944. Flame-damping and fire-proof properties are imparted to textile materials by treating them with a solution of a water-insoluble condensation product made by reacting, in the presence of an alcohol, a nitrogen compound containing a five- or six-membered heterocyclic ring in which the grouping  $-N:C.NHX$  (where X is H or  $NH_2$  and the atoms connected by the double bond form part of the heterocyclic ring) is present at least twice with an aldehyde, especially formaldehyde, or a substance liberating an aldehyde, and containing at least an equal weight of non-inflammable plasticizer and then heating. The material may be treated by dipping, steeping, soaking or padding and may afterwards be squeezed and dried before heating. The water-insoluble condensation product may be one obtained by heating melamine or a guanazole with formaldehyde or with a substance yielding formaldehyde in ethyl alcohol. Other five-membered or six-membered heterocyclic nitrogen-containing compounds of the character indicated, such as cyanuric trihydrazide, may be used. Suitable non-inflammable plasticizers are organic esters of phosphoric acid, especially chlorinated alkyl esters of phosphoric acid. The final properties of the materials can be varied by varying the relative proportions of the components and/or the duration and temperature of the heating treatment. The fire-proofing and fire-proof properties show a high standard of resistance to water. C.

**Cellulose Materials: Parchmentisation and Vulcanisation.** Tootal Broadhurst Lee Co. Ltd. and W. H. Roscoe. B.P.564,583 of 10/12/1942:4/10/1944. Cellulose materials, such as fibres, yarns, films, sheets, scoured sawdust, wood pulp or macerated paper are treated with sulphuric acid of parchmentising strength without substantial solution of the cellulose after a preparatory treatment with sulphuric acid of less than parchmentising strength. By subsequent pressing and drying the treated materials may be formed into a homogeneous mass valuable for its hardness, lightness and electrical insulation properties, and capable of being moulded under heat and pressure. C.

## 5—ANALYSIS, TESTING, GRADING AND DEFECTS

### (A)—FIBRES

**Cotton Fibre: Spinning Quality Tests.** A. C. Walters. *Textile World*, 1944, 94, No. 7, 58-59, 164-166. A brief review of American methods of testing cotton staple (Suter-Webb duplex sorter, Hertel fibrograph), fibre strength (Pressley and Chandler methods), fineness (weight per unit length), cross-sections and convolutions (microscope) and alignment of micelles (X-ray angle). C.

**Fibres: Molecular Structure.** C. S. Venable. *Textile Research*, 1944, 14, 179-182. The molecular structures of silk, wool, nylon, Vinyon, cellulose and cellulose derivative fibres are briefly described and discussed in relation to the properties and uses of the fibres. C.

**Pe-Ce and Nylon Fibres: Characteristics.** G. Romeo. *Raion*, 1942, 10, No. 7-8, 18-19 (through *Chem. Zentr.*, 1943, i, 694, and *Chem. Abstr.*, 1944, 38, 3482<sup>1</sup>). Photo-micrographs of the two fibres are shown. The Pe-Ce fibre is almost insoluble in 10 per cent. caustic potash and 58° Bé sulphuric acid, which dissolve all other fibres. It is very soluble in xylene, which can be used to dissolve it from fibre mixtures. Nylon is very soluble in pure formic acid; it can be precipitated from the solution by dilution with water. It is soluble in concentrated sulphuric acid and in boiling 80 per cent. acetic acid, insoluble in concentrated calcium thiocyanate solution at 70°. It can be separated from cellulosic fibres by its behaviour towards sulphuric acid, from cotton by its action with acetic acid, and from silk and cellulosic rayon by its reaction with calcium thiocyanate. C.

**Polyfibre: Characteristics and Moulding.** W. C. Goggin and R. R. Bradshaw. *Modern Plastics*, 1944, 21, No. 11, 101-107, 164, 166. A form of Polyfibre based on polystyrene ranging in size up to 5  $\mu$  in diameter is discussed. In its simplest form the product is a bat of parallel fibres which has an apparent specific gravity of about 0.05. It can be used as thermal and sound insulating material and also as a replacement for kapok in applications requiring buoyancy. Poly-

fibre can readily be moulded and products of specific gravities ranging from 0.4 to 1.05 are feasible. Compression mouldings are characterised by high tensile and impact strengths. Bag moulding processes are applicable to Polyfibre; a description of one method is given. The greatest strength in a moulding is developed in a direction parallel to the fibres. For uniform strength in all directions bats are arranged with the fibres in adjacent lays at 90° to each other. The effects of moulding time, temperature and pressure and the solvent content of the fibre on the specific gravity and strength of moulded products, and the relations between the specific gravity and the strength, hardness, dielectric constant and water absorption are shown in a series of graphs and discussed. C.

**Textile Fibres: Damage by Light.** J. Salquain. *Teintex*, 1942, 7, 275-281, 303-307 (through *Chem. Zentr.*, 1943, 1, 1233, and *Chem. Abstr.*, 1944, 38, 3482<sup>a</sup>). The effect of natural and artificial light on fibres and the humidity factor are discussed. Exposure of cotton to ultra-violet light alters the fluorescence, and increases the alkali-solubility and the absorption power for Fast Red Salt NB and Variamin Blue B. The formation of carboxyl groups and increase in reduction power are shown by the copper number and other tests. The chemical changes are accompanied by a weakening of the fibres. The hydrogen peroxide formed by solar rays oxidizes alcohol and aldehyde groups of cellulose to carboxyl groups and causes the formation of oxycellulose. Probably a splitting of the glucopyranose groups of the cellulose chain takes place. Wool is attacked at the S-S linkages of cystine and sulphur is split off; a thio-alcohol is produced as well as the easily decomposed sulphonic acid, which is converted to several intermediate products and finally to sulphuric acid. Reactions of the basic groups and the increase of the ammonia nitrogen and the amine groups are discussed. The hydrolytic decomposition of wool is shown by its increased alkali and water solubility and lower strength and elongation. Even the wool of the living animal is damaged by the sun. Damaging effects are shown by certain unreduced vat dyes, such as Indanthrene Gold Orange 3G, and naphthol dyes, such as Naphthol AS-G. Complex oxidation reactions are responsible in which the dyes are reduced. Vat dyes that undergo this reaction are Cibanon Orange R, Indanthrene Brilliant Orange 3G, and others. Oxides of iron, titanium and zinc act as catalysts. Fibre-weakening dyes should be avoided and finished fabrics should be protected with yellow or green light filters. Naphthols and amines protect by combining with oxygen. Wool can be protected by chroming. Fibres damaged by bleaching or alkali are damaged by sun more readily than those that have not been weakened chemically. C.

**Yucca, Nolina, Agave and Sotol Fibre: Strength.** C. W. Botkin, L. B. Shires and E. C. Smith. *New Mexico Agr. Exp. Sta. Tech. Bull.*, 300, 1943, 38 pp. (through *Chem. Abstr.*, 1944, 38, 3480<sup>7</sup>). *Yucca glauca*, *Y. elata* and *nolina* are sufficiently abundant in New Mexico and yield enough fibre to serve as a possible source of hard fibre to replace imported jute and hemp. No significant difference in strength of fibre was found between air-dried and green plants. Bacterial retting was effective on either green or dry leaves; inoculations were necessary for the best decomposition of the dry leaf. Retting of *nolina* was unsatisfactory but autoclaving at 15 lb. for 80 min. with 2 per cent. soda ash freed the fibre. The average breaking lengths were, respectively, 47, 44.7 and 32.2 km. The two *Yucca* fibres are thus equal to hemp in strength, and *nolina* is equal to sisal, jute, sansevieria and raw silk. On drying for 28 days in a well-ventilated room the leaves lost, respectively, 48.4, 54.1 and 41.2 per cent. moisture. They contained 42.3, 43.0 and 48.5 per cent. crude fibre, 4.86, 5.16 and 3.22 per cent. ash, and 5.57, 6.50 and 4.30 per cent. protein. Similar data are presented for the stems of these plants and for *Y. baccata*, *Y. macrocarpa*, *Agave lechuguilla* and Sotol. C.

**American Upland Cotton: Staple Length.** J. H. Moore. *J. Amer. Soc. Agron.*, 1943, 35, 491-498 (through *Exp. Sta. Rec.*, 1943, 89, 662-663). Measurements of combed staple length on the cotton seed and commercial staple length of 325 samples from representative cotton varieties grown on North Carolina farms for two seasons indicated a correlation coefficient of 0.89 between the two measures of fibre length. Since combed staple length on the seed can be measured by relatively inexperienced help, that method should be used wherever possible. C.

**Textile Fibres: Density.** J. W. Illingworth. *Textile Recorder*, 1944, 62, August, 60-65; September, 57-61, 67. A useful review is given of modern work by Davidson, Speakman and others. C.

**Wool, Off-sorts: Percentage, Shrinkage and Value.** E. M. Pohle and H. R. Keller. *Sheep and Goat Raiser*, 1944, 24, No. 10, pp. 12-13. Range wool, representing the 1943 clip produced by the Rambouillet, Targhee, Corriedale and Columbia breeds at the U.S. Sheep Experiment Station and Western Sheep Breeding Laboratory, Dubois, Idaho, was graded, and sorted into a main sort and a number of off-sorts (burry, paint, low and stained, crutchings, tags and sweepings). All lots were sorted and scoured by a commercial scourer. A table shows the percentage of each sort in each grade, and also the shrinkage and the Boston grease wool value. W.

**White New Zealand and Angora Rabbits: Coat Variations.** T. M. P. Hardy and M. H. Markley. *J. Heredity*, 1944, 35, 183-192. Homozygous short-haired, heterozygous short-haired (carrier), and the undesirable long-haired ("woolly") pelts of the domesticated white New Zealand rabbit were examined microscopically and compared with the Angora rabbit pelt. The hair of the Angora rabbit was of lesser diameter and of greater length. In length, number of medullary cells, cross-sectional diameter, and ratio of guard hairs to under-fur, the hair of the carrier type pelt occupied a position intermediate to the short- and long-haired coats. The greatest difference between the normal and hybrid short coats of the New Zealand rabbit was in the cross-sectional diameters of the guard hairs at the zone above the skin where the fibre attains its maximum diameter, and it is planned to use this measurement as a basis for future studies. W.

**Cuticular Scales of Hair: Staining.** J. Davidson and W. D. Taylor. *J. Quekett Microscopical Club*, 1943, Series 4, I, 289-293. A staining method to show the cuticular scale pattern of animal fibres is described. The air is first driven out of the fibres by cutting and placing in distilled water in a vacuum embedding oven. Staining is also done in a vacuum oven, using dilute Carbol Fuchsin in distilled water. W.

#### (B)—YARNS

**Sheeting Yarns: Effect of Acid on Breaking Strength.** C. E. Morrill. *Amer. Dyes. Rept.*, 1944, 33, 320-321. Tests were made on a bleached sheeting with 21.97s warp and 21.85s weft yarns. Squares were immersed in acid solutions of concentrations varying from 0.01 per cent. to 0.03 per cent. c.p. sulphuric acid and changes in the breaking strengths of single warp and weft yarns were determined with an Incline Plane Serigraph Model I-P-2. The data are tabulated and curves are given showing average changes in strength of warp and weft yarns against acid concentration. The results indicate that the acid had approximately the same tendering action on both warp and weft threads in the same piece of cloth. C.

**Yarns: Acoustic Determination of Modulus of Elasticity.** J. W. Ballou and S. Silverman (E. I. Du Pont de Nemours & Co.). *Textile World*, 1944, 94, No. 7, 99; *Rayon Textile Monthly*, 1944, 25, 282. Brief reference is made to a method of determining the elastic modulus of yarn from its sound transmission. The yarn is held taut with one end held by a weight over a pulley and the other supporting a horizontal bar of steel about 8 ins. long. The bar is excited by a radio-tube audio oscillator and vibrates at the 10-kilocycle frequency, emitting a very high note. The yarn is thus set in vibration like a violin string and the wave-length is accurately measured by a sliding crystal. The velocity of the sound is calculated from the wave-length and frequency, and the density of the fibre substance is then introduced into the calculation to give the modulus of elasticity. The values obtained are two or three times greater than those given by slow loading or static tests. C.

**The Control of Counts.** "Questor." *Wool Rec.*, 1944, 66, 318, 360, 403, 447, 489, 532. The application is considered of accepted methods of quality control to woollen and worsted spinning, the maintenance of a steady average count, the location and assessment of sources of variation in yarns, and the accumulation of data regarding the variability of the product as a whole being discussed. Certain conditions necessary to the proper functioning of quality control are outlined, viz., the isolation of irrelevant variables due respectively

to the regain factor and to the length unit of measurement, the deliberate selection of samples in order to achieve either true randomness or an accepted bias, the choice of suitable "control points," etc. Particular problems relating to the woollen and worsted processes are indicated, and it is shown how the use of quality control methods can increase the scope and the responsibility of the testing department. The final article discusses the research value of treating routine test methods by statistical means, and suggests the large part that an adoption of quality control methods might play in the future technical progress of wool spinning. W.

#### (C)—FABRICS

**Hosiery Abrasion Testing Machines: Comparison.** Margaret B. Hays and Dorothy C. Caudill. *Textile Research*, 1944, 14, 183-187. Tests were made on two constructions of Sea Island cotton hose (A) from 90s/2 yarns reinforced with a second 90s/2 yarn in the heel, sole and toe; (B) from 120s/2 yarns reinforced through the heel, sole and toe with an additional end of 90s/2 yarn. In the first testing machine cut toe and heel portions were mounted on a circular holder which revolved 60-70 times per minute beneath two fine abrading wheels which exerted a normal pressure of 500 gm. The counter reading was recorded when a hole was worn through in a section. In the other testing device the hose were placed on leg forms arranged so that the parts to be tested came into contact with cylinders around which strips of duck material were wound. The pressure against the cylinder on the toe was 485 gm. and the heel pressure 735 gm. The cylinders oscillated 40 cycles per minute. The results of tests on the toe and heel portions of 25 hose with the first machine and 50 hose with the second, and also of tests of high heel portions on the second machine are tabulated and discussed. Both machines showed that Construction A was more resistant to abrasion than Construction B and that no significant difference existed between the resistance to abrasion of the toe and heel. More cycles were required to produce a hole with the second machine than with the first. The random sampling error was less with the first machine than with the second. The first method required half as many test hose (but twice as many determinations) as the second. The second method required more time per hose, both as elapsed time and as operator time. C.

**Fabric: Determination of Air-permeability.** S. G. Popov and S. P. Palazov. *Izmeritelnaya Tekh.*, 1941, 3, No. 5, 27-32 (through *Chem. Zentr.*, 1943, i, 1345 and *Chem. Abstr.*, 1944, 38, 3482<sup>a</sup>). Devices suitable for determinations of the air-permeability of fabrics and formulae that can be used for evaluating the results are discussed. C.

**Fabrics; State of Tension in —.** W. Weltzien. *Monatsh. Seide Kunstseide*, 1939, 44, 429-430; *Mitt. Textilforsch.-Anstalt Krefeld*, 1939, 15, 80-81; 1941, 17, 7-11, 14-16 (through *Chem. Abstr.*, 1944, 38, 3482<sup>a</sup>). The results of various physical tests on silk, rayon, staple fibre, mercerised cotton, etc., are discussed. C.

**Quality Control Charts: Application in Textile Mills.** A. G. Ashcroft. *Textile World*, 1943, 93, No. 12, 69-71. A general account is given of the utility of Quality Control Charts as an aid to manufacturers working to the strict requirements of American service specifications. The following examples are reproduced. (1) Control of weight, strength, and yarns per inch of Army blanket; (2) The same for hard-texture duck; (3) Record of the porosity of cotton duck. C.

**Salt Spray Test Cabinet: Fog Calibration.** V. M. Darsey. *A.S.T.M. Bull.*, 1944, No. 128, 31-34. The salt spray test is a method of producing accelerated corrosion of articles placed in a finely divided dense wet fog produced and maintained by atomizing a 20 per cent. solution of sodium chloride with air inside a cabinet at 92-97° F. The deficiencies of the methods used for calibrating the fog inside a salt spray cabinet are pointed out. A report is given of investigations of the humidity produced by atomizing salt solutions of different concentration inside a test cabinet, and of the relationship between the humidity and the sodium chloride content of the fog. A method of calibrating the fog is suggested which depends on collecting a solution of fog in the cabinet and determining its salt concentration. A daily operating record of a large salt spray cabinet is presented. Various important factors in salt spray testing are considered. C.

**American Cotton Dress Fabrics: Quality, 1942 and 1943.** P. E. Keeney. *Missouri Sta. Res. Bul.* 375, 1943, 19 pp. (through *Exp. Sta. Rec.*, 1944, 90, 281-282). The fabrics for this study included percale prints, gingham, chambray, seersucker, light weight muslins, lawns and dimities, and were purchased from local stores in two groups, including 68 fabrics purchased in the spring of 1942 and 42 in February, 1943. Prices ranged from 19 to 79 ct. in 1942 and from 23 to 79 ct. in 1943, averaging 37 and 45 ct., respectively. Chambrays, gingham and lawns were higher priced in 1943. Lower thread count, more sizing, greater fabric strength (due to larger and stronger yarns), and little difference in shrinkage were observed in the 1943 purchases as compared with those for 1942. The majority of the fabrics purchased exceeded 2 per cent. shrinkage in both warp and weft. Most of the fabrics showed little loss of colour by crocking; only 12 per cent. of those purchased in 1942 and none in 1943 showed loss of colour by bleeding; 70 per cent. of the 1942 purchase and 64 per cent. of the 1943 purchase showed loss of colour in laundering; approximately 27 and 37 per cent. of these two groups, respectively, failed to show loss of colour after 40 hours' exposure in the Fade-Ometer. In all tests for colour fastness the percale prints showed the greatest tendency toward loss of colour. Rose, green, tan and blue showed the least colour permanency. Tests of house dresses are also noted. C.

**American Drapery Fabrics: Quality, 1942 and 1943.** P. E. Keeney. *Missouri Sta. Res. Bul.* 374, 1943, 18 pp. (through *Exp. Sta. Rec.*, 1944, 90, 282). The draperies studied were purchased at three stores (in Missouri) in two groups consisting, respectively, of 40 fabrics of varied textures, colours, designs and prices purchased in June, 1942, and representing goods of pre-war fabrication, and 24 fabrics purchased in February, 1943. In both groups the majority of the fabrics were of cotton; the few containing rayon or linen were considerably more expensive than the cotton. Widths varied from 35 to 53 in., the majority (70 per cent.) being 48 in. wide. Weight per sq. yd. varied from 3.2 to 10.3 oz., with a range of from 5.0 to 7.7 oz. for the majority of fabrics. Very little relationship existed between the weight of the fabric and its construction and durability due to wide variation in strength and structure of the yarns, and price was no indication of durability. Fabrics purchased in 1943 had lower thread counts, without the expected decrease in strength, than those obtained in 1942. Greater shrinkage in laundering and dry cleaning was apparent, however, in fabrics purchased in 1943. The few labels pertaining to shrinkage that appeared on fabrics were found to be dependable. The label information pertaining to colour fastness was not very reliable, however, according to the results obtained in colour fastness tests. Of the fabrics purchased in 1942, 19 showed no loss of colour after 80 hours of exposure in the Fade-Ometer, as compared with 5 fabrics purchased in 1943. C.

**American Service Clothing: Physiological Testing.** *Textile Research*, 1944, 14, 222-227. In physiological testing, as practised by the American Quartermaster Corps, climatic conditions representative of the area for which the garment is designed are selected and reproduced. Garments for arctic use are tested at temperatures down to  $-40^{\circ}\text{F.}$ , with or without wind, and those for tropical use at  $85^{\circ}\text{F.}$  and 85 per cent. R.H. Rain or snow may be added. Measurements are made of skin temperatures, sweat rates and *Clo* values, the *Clo* being the amount of insulation provided by a suit which affords comfort, at least to the average American, at  $70^{\circ}\text{F.}$  when he is inactive in still air. Investigations have shown that gloves or mittens constructed of materials known at present cannot keep the hands of inactive persons adequately warm at temperatures much below freezing. Increases in thickness are accompanied by disproportionate increases in radiating surfaces and by losses in dexterity. Wool pile fabrics half an inch thick are suitable for cold weather clothing. As a result of tests of clothing for tropical climates, preferences have been expressed for poplin. Lighter weight and thinner textiles impose less heat stress as measured by the sweat rate, and close, tight weaves materially reduce mosquito bites. Investigations of garments intended for protection against rain have resulted in the development of a garment made from coated Nylon. C.

**Clothing Fabrics: Functional Characteristics.** G. F. Doriot. *Textile Research*, 1944, 14, 217-219. A report of an address. It is suggested that the textile and clothing industries should encourage young men to embark early on a career of training, and to specialise in a particular phase. Army experience



of discomfort in the wear of clothing impermeable or permeable to vapour and of a pattern of wear which is associated with some physical property only doubtfully represented by tensile and tearing strength is discussed, and it is suggested that the industry could profitably have applied its scientific ability to such problems and to the study of the durability, functional characteristics and performance required by the consumer. C.

**Textile Fabrics: Warmth.** J. W. Illingworth. *Textile Recorder*, 1944, 61, March, 56-59; April, 55-60; 62, June, 60-64; July, 67-70, 73. The thermal properties of clothing fabrics are reviewed in the light of modern research, under the headings (1) physiological aspects, (2) body temperature, (3) desirable attributes of clothing, (4) the importance of entrapped air in clothing, (5) the Kata thermometer, (6) constant temperature methods of test, (7) effects of cloth thickness and density, weave, multiplicity of layers and closeness of fit, (8) effects of air movement and humidity, (9) effect of washing and finishing, (10) surface emissivity, (11) moisture content and cold feel, (12) moisture permeability, (13) thermostatic effect of moisture, (14) comparisons of various fibres, (15) protection from sunburn, (16) all-wool and part-wool blankets, (17) part-wool clothing, (18) asbestos and glass fibres, and (19) protection from exposure. C.

**Sampling Plan for Wool Textiles.** Philadelphia Quartermaster Depôt. *Text. World*, 1944, 94, No. 5, 88-89. The plan is designed to measure, in addition to width and length, the following attributes observed by visual inspection and not by laboratory tests: (a) shade, from side to side, or from end to end; (b) shivy material; (c) slubby material; (d) holes; (e) coarse yarn. A rejected piece of material is defined as being more than  $2\frac{1}{2}$  per cent. defective. The sampling plan, which is a double one, is a compromise between an average out-going quality level and lot-by-lot acceptance, and is a 10 per cent. consumer risk. Tables show the classification of fabrics into 3 groups (purpose for which used, cost, and urgency of the need), and the corresponding sampling required. W.

#### (D)—OTHER MATERIALS

**Textile Preservatives: Testing.** H. J. Bunker. *Proc. Soc. Agr. Bacteriologists*, 1943, 9-12 (through *Chem. Abstr.*, 1944, 38, 3483<sup>8</sup>). Pieces of fabric are treated with preservatives, then fixed on aluminium frames and buried vertically in a typical light garden soil, kept at 30° and 20 per cent. water content. They are tested weekly for strength by attempting to tear them by hand. C.

**Vinyl Chloride-Acetate Non-rigid Resin Compounds: Stiffness and Brittleness.** R. F. Clash, Jr., and R. M. Berg. *Modern Plastics*, 1944, 21, No. 11, 119-124, 160. The cantilever beam test for the determination of the stiffness in flexure of non-rigid plastics (A.S.T.M. D747) and a torsion test ("Flex Test") for stiffness are discussed. Data are presented showing agreement between results obtained by the two methods for compounds containing 25-45 per cent. dioctyl phthalate in vinyl chloride-acetate resin VYNW at temperatures in the range -56.7° C. to 25° C. An apparatus for testing brittleness which conforms to the requirements of A.S.T.M. D746 is also described. Results are expressed as brittleness temperature, i.e. the lowest temperature of non-failure of five consecutive test specimens of a given material when struck by a moving arm under specified conditions. Results of stiffness and brittleness tests on three series of plasticized compounds based on vinyl chloride-acetate resin VYNW and a range of concentrations of tricresyl phosphate, dioctyl phthalate, and trioctyl phosphate plasticizers, respectively, are discussed. Inverted "S"-shaped families of curves are obtained representing the log stiffness-temperature function for these plasticizers in the concentration range 25-45 per cent. Plasticizer addition above 25 per cent. appears only to translate the curves toward lower temperatures. The brittleness contour superposed on the stiffness curves shows that impact failure is not simply related to stiffness but includes other factors, among them plasticizer type and concentration. The three plasticizers have the same sort of effect on both properties but to widely different degrees. The curve showing stiffness at 25° C. as a function of dioctyl phthalate concentration also has a characteristic inverted "S" shape. C.

**Drop Ball Impact Testing Machine: Application to Plastics.** G. Lubin and R. R. Winans. *A.S.T.M. Bull.*, 1944, No. 128, 13-18. The Izod-type pendulum machine is not suitable for determining the shock resistance or impact strength of plastics, and a drop ball impact machine is described and shown in photo-



graphs. Izod specimens with the notch milled in on the face are used. The single-blow test consists of dropping hardened steel balls by means of a special electro-magnet on to the specimen supported in a vice. The height of drop can be varied. For multi-blow impact fatigue tests an arrangement is provided for delivering a ball every 4 to 10 sec. to the magnet. An automatic cut-off stops the machine when the sample is broken or cracked. Three methods of testing are described. Results obtained in tests on laminated phenolic, moulded phenolic and thermoplastic materials are presented in tables and graphs, and are compared with results obtained with the Izod pendulum machine. Photomicrographs showing types of fractures are given. C.

## PATENT

**Quality Control Calculating Device.** Bellings & Lee Ltd. and C. W. Heath. B.P. 564,520 of 4/3/1943:2/10/1944. A calculating device for performing industrial quality control calculations comprises a base bearing a calibrated circular or part-circular scale, a disc or part of a disc rotatable about the centre of the scale and bearing a zero datum line or equivalent marking disposed adjacent the scale to co-operate therewith, and a linear scale rotatable about the centre of the disc and slidable radially thereof, the disc or part of a disc bearing a number of predetermined curves originating from the zero datum line. Details of the method of operation are given. C.

## 7—LAUNDERING AND DRY-CLEANING

## (A)—CLEANING

**Soaps: Wetting Action.** Sadgopal. *Soap, Perfumery Cosmetics*, 1944, 17, 258-259 (through Chem. Abstr., 1944, 38, 3501<sup>1</sup>). The Na and K soaps of fatty acids from  $C_4$  to  $C_{18}$  have very little wetting action on soiled fabrics. This action begins with soaps of both saturated and unsaturated  $C_{12}$  to  $C_{20}$  fatty acids. Ricinoleates possess very little wetting action. The myristates have the maximum wetting action of the saturated acids. Oleates are better than linoleates and K soaps are better than Na soaps. The action of soaps is dependent on the total predominant fatty glyceride components. The soaps of castor oil rich in ricinoleic glycerides have very little wetting power, whilst almond, olive and sesame and other oils, rich in oleic glycerides, have good wetting activity. Soaps of hard fats like mahuwa and tallow are good wetting agents at high temperatures. Coconut soaps possess the best wetting properties because of their richness in myristic glycerides. Soaps from hardened fats possess poor wetting activity. Wetting action is high at high temperatures. Rosinates, however, have less wetting action at high temperatures. C.

**Fabrics: Laundering; Losses due to Lint Formation.** W. Kind and O. Oldenroth. *Bastfaser*, 1942, 2, 147-153 (through Chem. Zentr., 1943, i, 1014 and Chem. Abstr., 1944, 38, 3846<sup>3</sup>). Linen, twill and satin fabrics were laundered in a 35 kg. drum. Losses due to lint formation were determined after 5 and 50 washings by weighing the samples and by filtering the lint from a measured amount of the wash water. Experiments with various sudsing materials indicated that the usual suds, consisting of large bubbles, have no protective properties. An increased rate of rotation of the drum causes greater lint formation. The strength of the washing solution is of little significance; the chief losses appear only in rinsing. Prolonged dry running of the washing drum when the washing solution is changed is harmful. C.

**Sodium Secondary Alkyl Sulphates: Detergency; Effect of Electrolytes.** R. G. Aickin. *J. Soc. Dyers & Col.*, 1944, 60, 170-176. An account is given of investigations of the effect of the addition of various alkali metal and alkaline earth halides on the removal of olive oil from wool by secondary alkyl sulphates. Data showing the effects of electrolyte concentration, temperature and pH are presented. It is found that the initial reduction in the efficiency of the process brought about by addition of electrolytes is followed by a very large increase in the efficiency at higher concentrations. The electrolyte effect is largely due to the ions of sign opposite to that of the long-chain ions, and divalent ions are much more effective than the univalent ions. The various univalent ions fall into a series as regards their influence, viz.  $K > NH_4 > Na > Li$ . The observed effects are explained in terms of the interfacial forces, viz. those existing between the oil, the detergent solution and the textile fibre, which are involved in the actual removal of the oil from the fibre. Another major factor

involved is that of the stability of the emulsion produced by dispersion of the removed oil in the detergent solution. C.

#### PATENTS

**Control Means for a Power Actuated Machine.** H. H. Brownlee. B.P.564,605 of 12/1/1943:5/10/1944. In a garment press of the polished head type a device is usually fitted to ensure that the operator has to use both hands to close the press, but the danger to bystanders is not thereby removed. This specification describes a means for opening the press immediately anyone comes within a predetermined distance from it, and of closing it again when they leave this area. Further, the press can be made to open when the garment is dry. The control is based on a magnetically operated air valve which is made to function by suitable valve circuits. The metalwork of the press forms part of the input circuit to a three-electrode valve, and a series of relays culminating in the air valve are connected in the output circuit. The characteristics are arranged so that when the press is unattended it automatically shuts; when a person approaches within a certain distance of the press, the characteristics are changed and the press immediately opens. By incorporating a moisture or thermostatic switch in the back of the press, it can be made to open when the garment is dry. La.

**Control-Means for a Machine adapted to operate on Moist Articles.** H. H. Brownlee. B.P.564,606 of 12/1/1943:5/10/1944. The object of this invention is an improvement of the means whereby a garment press is automatically opened when the garment has reached a definite state of dryness. The operator has to close the press by operating two manual switches, but these open on being released. As soon as the head comes into contact with the wet garment, current is made to flow in the plate circuit of a valve so that a magnetically operated air valve keeps the press closed. When the garment has reached a certain state of dryness, the plate current is reduced and the air valve allows the press to open. The arrangement can also be controlled by thermostatically operated contacts in the head of the press and a simplified circuit. La.

**Improved Process and Apparatus for Treating Liquid.** W. Paterson. B.P.564,708 of 3/4/1943:10/10/1944. This invention is an improvement of the continuous flow softening process described in B.P.10,719 (1902), and is of particular use in the lime softening of water. The liquid is mixed and agitated with previously formed sludge or other catalytic agent and fresh reagent in a special tank. The tank is arranged so that the mixture travels from one end to the other in a horizontal direction and during its passage through the tank the mixture is subjected to a spray or cascade of the sludge or catalytic agent. The sprays are produced by power-driven means and the method ensures effective treatment without short circuiting by the raw water. La.

## 8—BUILDING AND ENGINEERING

### (D)—POWER TRANSMISSION

**Lubricating Oil Addition Agents.** R. Schnurmann. *Chemical Products*, 1944, 7, 56-60. Addition agents for lubricating oils are classified into (1) extreme pressure additives, (2) viscosity index improvers, (3) pour point depressants, (4) oxidation inhibitors, (5) bearing corrosion inhibitors, and (6) detergents, and are briefly discussed. C.

### (F)—LIGHTING

**Textile Mills: Scientific Lighting.** J. W. Howell. *J. Soc. Dyers & Col.*, 1944, 60, 161-170. Sight and seeing, the process of seeing, accuracy of seeing, light measurement and the adequacy of illumination are briefly discussed. Lighting requirements in wool grading and sorting, healding or drawing-in, weaving, perching, dyeing and printing departments are studied, suitable lighting arrangements, including systems employing fluorescent tubes are considered, and photographs are given. Data are presented showing increases in output and quality, and the net profits resulting from better lighting in worsted weaving, and silk and rayon warping and weaving processes. The use of day-light lamps and other colour corrected sources, particularly for colour matching, is discussed. The use of infra-red lamps for heating is also discussed. C.

## (G)—HEATING, VENTILATION AND HUMIDIFICATION

**Electrostatic Air Cleaning System.** Judson Mills Inc. *Textile World*, 1944, 94, No. 6, 88-90. An illustrated account is given of an air-conditioning system equipped with an electrostatic "precipitron" supplied by the Westinghouse Electric Co. Air is supplied by a 60-h.p. electric blower to a set of four precipitrons, each dealing with 125,000 cub. ft. per minute. The deposited dirt is washed off each unit in turn, by hand, and allowed to pass to the drain. The ionizing section of the precipitron operates with a 13,000 volt charge and the collector section with 6,000 volts. These d.c. voltages are supplied from a 115-v. a.c. unit. The power consumption is about 15 watts per 1,000 cub. ft. of air per minute. In the winter air is re-circulated and only about 10-15 per cent. is taken from outside. In summer, fresh air only is circulated. The weaving shed was kept for a year at 82-85° F. (even on a day when the outside temperature was 98°) and the relative humidity was controlled as required between 70 and 80 per cent. C.

**"Precipitron" Electrostatic Dust Precipitator.** *J. Appl. Physics*, 1944, 15, No. 7, xvi. In the electrostatic unit known as the Precipitron the generation of ozone by the discharge current has been reduced to such a point that the ozone concentration in the air is no more than that found in outdoor air in bright sunlight. A compact unit small enough to be placed in an ordinary window has been developed. Industrial uses of the Precipitron for removing oil mist, dust, pollen, etc., are mentioned. C.

## (H)—WATER PURIFICATION

**Lime-Soda Water Softening Plant: Automatic Control.** F. A. Champion. *J. Soc. Chem. Ind.*, 1944, 63, 204-208. An automatic method has been devised in the laboratory for controlling lime-soda softening of a variable mixture of several constituent waters, when each of the latter is of reasonably constant composition. Theoretical consideration of such general cases, and experimental work on an actual water of this type, have shown that the quantity of reagents required per gallon of raw water is proportional to the conductivity of the latter. The rate of flow of the raw water may be measured by noting the effect of the variable level of the water above a weir on the resistance of a partly immersed conductivity cell of special design. By suitably shaping the electrodes, this cell may be used to measure both the hardness and the rate of flow of the water and hence to determine the quantity of reagent required per hour for softening. Thermionic relays incorporating automatic temperature correction are suggested for using the resistance of this dual-purpose cell to operate an electrical device, such as a solenoid, which, in turn, controls the valve of the dosing gear. Three examples of suitable dosing gear are outlined. C.

**Water for Textile Processing: Quality and Treatment.** L. B. Miller. *Cotton (U.S.)*, 1944, 108, No. 7, 85-88, 132-133. A general review of natural water supplies, constituents that are deleterious in textile processing, softening, removal of iron and manganese, bacterial growths in pipes and tanks, turbidity and colour, microbiological growths, and pollution of supplies. A textile process water should have as maximum limits: hardness 50 parts per million (as  $\text{CaCO}_3$ ), Fe 0.2, Mn 0.1, heavy metals *nil*, turbidity 25 and colour 50, p.p.m. C.

**Water Softening and Filtration Plant.** *Rayon Textile Monthly*, 1944, 25, 299-302. A general account is given of the zeolite process for softening water, with illustrations of single-unit and triple unit filters and a zeolite softener (Graver Tank and Manufacturing Co.), a filtration plant and a zeolite installation (Roberts Filter Manufacturing Co.), and a water softening installation with selective-automatic valve control (Refinite Corporation). Mention is also made of a coagulator and a filter for caustic liquors in mercerising or caustic soda recovery (Hungerford and Terry Co.). C.

## (I)—WASTE DISPOSAL

**Mercurial Ointment: Preparation.** N. A. Kessler and H. G. DeKay. *J. Amer. Pharm. Assoc.*, 1944, 33, 118-122 (through *Chem. Abs.*, 1944, 38, 2790). Formulæ are given for improved dispersion and precipitation methods for preparing mercurial ointment. Various substances, including wool fat, are capable of dispersing mercury, wool fat being a better dispersing agent for mercury than mercury oleate. W.

## PATENT

**Sleeve Air Filter.** C. C. Marston. B.P. 564,161 of 12/1/1943:15/9/1944. An air or gas filter comprising a hollow textile member (e.g. a sleeve) through which dust-laden air or gas passes for filtering is fitted with power-driven means for continuous and regular mechanical shaking, and is divided into a number of non-extensible parts by one or more interposed resiliently extensible sections. The latter may consist of a resilient section such as of elastic material (e.g. elastic webbing or other elastic fabric) which will enable the sleeve to be hung taut and to be further tautened or extended and released evenly without undue shock or strain. C.

## 9—PURE SCIENCE

**Nitrocellulose Molecules: Weight and Shape.** H. Campbell and P. Johnson. *Trans. Faraday Soc.*, 1944, 40, 221-233. Viscosity, sedimentation velocity, and diffusion measurements have been made on solutions in acetone of some commercial nitrocelluloses, and compared with similar measurements on the so-called globular proteins. By means of equations connecting viscosity and molecular shape, and my making certain assumptions, molecular weight values have been calculated for nitrocellulose fractions from viscosity measurements. For the calculation of molecular weight from sedimentation velocity and diffusion measurements, the experimental requirements for accurate work are pointed out. The dangers of extrapolating to zero solute concentration from measurements on solutions of too high solute concentration are emphasized. Until molecular weights of many fractions of nitrocellulose have been accurately obtained, no decision regarding the validity of the viscosity equations can be attempted. Data so far obtained are in agreement with the view that the nitrocellulose molecule in acetone is a long, almost completely stretched chain of nitrated glucosidic residues, the chain diameter of which is considerably increased by solvation, and in which some little flexibility may be assumed. C.

**Polyvinyl Chloride: Rheological Properties.** L. Bilmes. *J. Soc. Chem. Ind.*, 1944, 63, 182-184. The rheological properties of plasticised polyvinyl chloride have been studied in a specially constructed torsion apparatus over the temperature range  $-70^{\circ}$  to  $100^{\circ}$ . The results are analysed by means of the Nutting equation,  $\psi = S\beta\sigma^{-1}t^k$ , where  $S$  is the shearing stress,  $\sigma$  the strain,  $t$  the time,  $\psi$  the firmness, and  $\beta$  and  $k$  are constants. On raising the temperature from  $-70^{\circ}$  to  $+140^{\circ}$  the material passes through glassy, leathery, rubbery and plastic states, and it is possible to characterise these states by the values of  $\psi$  and  $k$  associated with them. The rheological properties of the different grades of polyvinyl chloride tested appeared to differ only in being displaced over a temperature scale. Increasing the plasticiser content shifted the  $\psi$ /temperature and the  $k$ /temperature curves towards the lower end of the temperature scale. C.

**Fluorescent Lamps: Cross-prism Investigation.** F. E. E. Germann and R. Woodriff. *Rev. Sci. Instruments*, 1944, 15, 145-149. A cross-prism method is described whereby a single photograph of a fluorescence spectrum gives directly both intensity and spectral distribution of fluorescent light produced by exciting light of all wave lengths. A vertical scanning of such a photograph gives the variation of light intensity of a given wave length as a function of the exciting wave length. A horizontal scanning gives the spectral energy distribution as a function of wave length for a given frequency of exciting light. With a continuous source of ultra-violet radiation, a single exposure thus gives all information necessary to determine the best frequencies of exciting light to produce a maximum fluorescent light of a given colour or energy distribution. C.

**Fats and Fatty Acids: Unsaturation and Ultra-violet Absorption Spectra.** R. H. Barnes, I. I. Rusoff, E. S. Miller and G. O. Burr. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 385-386. The spectral absorption of several unsaturated fatty acids and natural fats has been measured from 2,500 to 2,100 Å. Data are presented that show a definite relationship between the degree of unsaturation and extinction coefficients at 2,100 Å. It is possible to predict the extent of absorption at this wave length by natural fats from a knowledge of their compositions. C.

**Workshop Microscope.** Messrs. Machine Shop Equipment Ltd. *Engineering*, 1944, 158, 216; *Industrial Chemist*, 1944, 20, 508. A brief description is given of a compact microscope for direct application to machine parts. The magnification is  $\times 40$  and the field of view about 0.2 in. diameter. The optical system is a  $1\frac{1}{2}$ -in. objective and micrometer eyepiece containing a scale graduated in 100 divisions of 0.001 in. The eyepiece can be focused independently to give a sharp image of the scale. Lighting is from the mains or a No. 8 dry battery. C.

**Starch Suspensions; Depolarization of Light by —.** A. Boutaric and M. Chapeaux. *J. chim. phys.*, 1942, 39, 73-76 (through *Chem. Zentr.*, 1943, i, 255-256 and *Chem. Abstr.*, 1944, 38, 2869<sup>3</sup>). To check the unexpected experimental results of Calinicenco, rice starch suspensions previously heated to 71, 77, 82 and 90° were examined as to change in optical density and degree of depolarization. From the curves it appears that the degree of depolarization diminishes for equal concentrations with rising temperature (agglutination), but does not reach zero. For equal temperatures the coefficient of depolarization at first rises steeply with increasing concentration and then approaches a limiting value asymptotically. The depolarization does not seem to be necessarily bound to the presence of doubly refracting particles. C.

**Cellulose Ester, Gelatin and Polyvinyl Derivative Discs: Electrical Anisotropy.** S. E. Sheppard and P. T. Newsome. *J. Chem. Phys.*, 1944, 12, 244-248. A number of colloid materials, including proteins and cellulose and polyvinyl derivatives, were obtained in sheet form and stretched to elongations of 100 per cent. or more. Circular discs were cut from the sheets and their degree of orientation measured in an alternating electric field. The relation of the orientation to field strength, thickness, humidity and moisture content is discussed. The results show that the property of electrical anisotropy, induced by stretching, is not displayed by all kinds of natural and synthetic colloids, but is limited (a) to those containing an appreciable amount of fixed hydroxyl and/or absorbed water, and (b) those capable of absorbing considerable amounts of water. With gelatin and hydrolysed cellulose acetate, the electrical anisotropy varies with absorbed water content, but with polyvinyl alcohol it is independent of the water content. C.

**Organic Plastics: Effect of Temperature on Mechanical Properties.** T. S. Carswell and H. K. Nason. *Modern Plastics*, 1944, 21, No. 10, 121-126, 158, 160. The tensile stress-strain curve of organic plastics is discussed and the characteristic features of the curves associated with different types, e.g. soft, weak and hard, tough materials are, indicated. With all true thermoplastics the slope of the initial Hookean or elastic portion of the stress-strain curve decreases, the magnitude of the maximum stress at the yield point decreases, and the point of rupture tends to move along the curve toward higher values of strain as the temperature is increased. Thermosetting materials show the first two changes, although to a less degree than thermoplastic materials, and a tendency to the third. A plastic which is tough and ductile at room temperature, e.g. cellulose acetate, may become brittle and hard at low temperatures, and plastics which are brittle and hard at room temperatures, e.g. polymethyl methacrylate, may become tough and ductile at elevated temperatures. Because of variations in stress distribution and in magnitude of combined stresses (tension, compression and shear) acting simultaneously, it is possible for a material, held at constant temperature, to be tough and ductile under one set of conditions, but brittle and hard under another. Curves showing the effect of temperature on the tensile strength, yield stress, extensibility, modulus of elasticity, compressive strength, flexural strength, shear strength and impact strength of several plastics are presented and briefly discussed. An extensive bibliography is given. C.

**Formaldehyde: Effect on Protein.** S. Fiala. *Naturwissenschaften*, 1943, 31, 370 (through *Chem. Abs.*, 1944, 38, 2053). The effect of formaldehyde on protein was studied polarographically. Protein in borax-buffered solution (pH 7.9.5) shows upon addition of formaldehyde an immediate lowering of the double wave of the protein in the polarogram. The lowering is proportional to the formaldehyde concentration, to pH and to temperature. The process is irreversible. The result contradicts the hydrolysis theory of the formaldehyde effect, but points toward aggregation or condensation of protein molecules.

This is confirmed by the increased surface tension and the lowered protective colloid action of formaldehyde-treated protein. W.

**Fibrous Proteins: Combination with Acids.** G. A. Gilbert and E. K. Rideal. *Proc. Roy. Soc. A.*, 1944, 182, 335-346. An approximate titration equation is developed for the reaction between fibrous proteins and acids, in which account is taken of the valency and intrinsic affinities of the acid anions and of the limited number of adsorption sites available for anions. The differences between this hypothesis and that of Steinhardt and Harris (these *Abs.*, 1940, A291) are indicated. W.

**Protein-formaldehyde Reaction: Wool.** E. R. Theis and M. M. Lams. *J. Biol. Chem.*, 1944, 154, 99-103. After reaction with formaldehyde, the amount of acid or base with which wool combines is unaltered over the pH range 1-9.5, but it combines with a slightly larger amount of base at >pH 9.5. At pH 1-5 formaldehyde combines with acid amide and/or imino groups of the polypeptide chain. In addition, it combines with the imidazole group of histidine at >pH 6.1 and with the terminal amino group of lysine at >pH 10.5. At pH 9.5-12 wool combines with more formaldehyde than corresponds to the lysine content, this difference being probably due to reaction of the formaldehyde with the wool sulphur. W.

**Reaction of Formaldehyde with Keratin.** J. L. Stoves. *Nature*, 1944, 154, 272-273. On the basis of supercontraction experiments it is suggested that new cross-linkages are formed in wool and deaminated wool fibres by treatment with formaldehyde at pH 1 and 10.5 for 1 hr. at 100°. These linkages are not formed in either normal or deaminated fibres by treatment with formaldehyde at pH 5 and 100° for 1 hr. W.

**Wool Blends: Spectrophotometric Prediction of Colour.** E. I. Stearns and F. Noechel. *Amer. Dyes. Rep.*, 1944, 33, 177-180. An empirical relation has been derived between the reflection coefficient of the components of a blend and the reflection of the blend, for any particular wave-length. By means of this relation the spectral reflection curve of the blend can be obtained from that of the components. Diagrams are given showing the close agreement between the calculated and observed curves for a number of blends. For wool the relation is:

$$100 \frac{100-R}{0.15(R-1)+1} = \frac{100-R_1}{0.15(R_1-1)+1} + b \frac{100-R_2}{0.15(R_2-1)+1}$$

where R = the percentage reflection of the blend,  $R_1$  and  $R_2$  = the reflection of components and a and b = the percentages of the components in the blend. W.

#### PATENTS

**Soluble Starch: Production.** M. D. Rozenbroek (Netherlands; vested in U.S. Alien Property Custodian). U.S.P. 2,338,457. Powdered starch containing 8-20 per cent. of moisture is mixed with about 15 parts by weight of sodium carbonate and then treated with chlorine gas at a temperature below 60° C. The amount of chlorine passed in is about 6 per cent. of the weight of starch. C.

**Carbamylethyl Cellulose Ester: Production.** Röhm & Haas Co. U.S.P. 2,338,681. Cellulose is caused to react at 0-40° C. with acrylamide in the presence of a strong base (10-40 per cent. aqueous solution) until carbamylethyl groups are introduced into the cellulose and some part of them have been further hydrolyzed to carboxyethyl groups. At least 0.2 mol. of acrylamide is used for each glucose unit. C.

**Cotton Plant: Metabolism.** F. J. Richards. *Ann. Botany*, 1944, [New Ser.], 8, 43-55. The methods used by Mason and Phillis in analysing their data are examined and it is shown that many of their conclusions and theories are not supported by the data. Without further experimental evidence, supplemented by adequate statistical analysis, both the water-content relations and the partitioning between soluble and insoluble fractions of N, P and carbohydrate are more complex phenomena than envisaged by Mason and Phillis. C.

**Inter-specific Cotton Hybrid: Fertility.** S. Nakatomi. *Plant Breed. News*, 1934, 9, 548-549 (through *Plant Breed. Abstr.*, 1944, 14, 226). An  $F_1$  plant from the Egyptian Ashmouni ( $n=26$ ) × a Manchurian variety (*G. herbaceum*,  $n=13$ ) bore no seed when selfed, but on being pollinated by Kings Improved

(*G. hirsutum*,  $n=26$ ) gave a few seeds. A plant raised from among these flowered abundantly and was partly fertile, selfed or crossed. It had  $n=26$  chromosomes. C.

**Polyploid Cottons: Cytology.** A. J. T. Mendes. *Bragantia*, São Paulo, 1942, 2, 101-110 (through *Plant Breed. Abstr.*, 1944, 14, 226). In a study of polyploid cottons obtained by colchicine treatment, immersion of delinted seeds in a 0.15 per cent. solution for 16 hours was found to be most effective. Some plants of *G. hirsutum* failed to react at all, whereas in *G. herbaceum* all plants reacted equally. Most of the roots of the abnormal looking plants of *G. hirsutum* proved to contain a mixture of tissues with  $2n=52$  and  $2n=104$ ; flowers with mixed tetraploid and octoploid tissue were also encountered. At anaphase I in the octoploids 52 chromosomes generally went to each pole, but various deviations were also occasionally observed. Secondary association was of frequent occurrence. Pollen formation was more or less normal but the anthers mostly failed to dehisce. The pollen was larger and more variable in size than in normal plants. No seed was obtained either from self-pollination or from cross-pollination with either octoploid or tetraploid. Occasional fruits were formed from open pollination; the seeds obtained, which were usually abnormally large, could often be induced to germinate only by incision of the testa. The plants produced frequently had  $2n=52$  chromosomes. C.

**Mechanical Wood Pulp: Attack by Fungi.** E. Rennerfelt. *Svensk botan. Tid.*, 1942, 36, 301-311 (through *Chem. Zentr.*, 1942, ii, 1194, and *Chem. Abstr.*, 1944, 38, 3469<sup>8</sup>). Mechanical wood pulp was inoculated with 20 different species of fungi. Only some, as *Fomes annosus*, *Lenzites betulina* and *Polyporus vaporarius* (Eberswalde), markedly attacked the wood pulp with a brown colouration and loss of weight of 19-25 per cent. Others, known as typical pests on dead conifers, such as *Lentinus lepideus* and *Lenzites abietina*, had scarcely any noticeable action on the pulp. If the entrance of the fungi is parallel to the pulp sheet, the action is greater than if it is perpendicular. Pulp from 8 different wood pulp plants showed variation of 12 up to 25 per cent. loss of weight upon inoculation with *Polyporus versicolor*; material put through a hydraulic press was attacked more rapidly than that which had been kamyr dried. C.

**Acetone: Micro-determination.** L. A. Greenberg and D. Lester. *J. Biol. Chem.*, 1944, 154, 177-190. A rapid, sensitive and accurate method for determining acetone in air and biological fluids is based upon the reaction of acetone with 2:4-dinitrophenylhydrazine to form the corresponding hydrazone, the separation of the hydrazone by extraction with carbon tetrachloride, and its colorimetric determination in this fluid. Applications of the method, and modifications, to the determination of total and individual ketone bodies (acetone, acetoacetic acid and  $\beta$ -hydroxybutyric acid) in blood and urine are also described. C.

**Alkanolamines: Volumetric Determination.** J. H. Jones. *J. Assoc. Offic. Agric. Chemists*, 1944, 27, 309-317. In a semi-micro volumetric method for the determination of alkanolamines in emulsions the amine is extracted with hydrochloric or hydrobromic acid, excess acid is removed by evaporation, and the amine is liberated by treatment with silver oxide, filtered and titrated with standard acid. The necessary correction for dissolved silver oxide is easily determined by titration with potassium iodide solution and starch-iodine indicator. When an inorganic base is also present the method may be used to determine the total base. Details of the procedure and typical results are given. C.

**2-Aminoanthraquinone: Determination and Identification.** O. L. Evenson. *J. Assoc. Offic. Agric. Chemists*, 1944, 27, 317-319. A colorimetric method for the determination of 2-aminoanthraquinone in D. & C. Blue No. 9 (3:3'-dichloroindanthrene) comprises removing the intermediate from the dye, treating with bromine to form 2-amino-1:3-dibromoanthraquinone and comparing the latter colorimetrically with standards. A 95 per cent. recovery is indicated. The preparation of 2-amino-1:3-dibromoanthraquinone and its acetyl derivative for identification of the intermediate is also described. C.

**Fats: Spectrophotometric Analysis.** B. W. Beadle and H. R. Kraybill. *J. Amer. Chem. Soc.*, 1944, 66, 1232. In the examination of animal fats containing small amounts of arachidonic acid by the method of Mitchell, Kraybill



and Zscheile, it is not possible to make a quantitative analysis for the arachidonic acid without a reference standard. Purified methyl arachidonate was therefore subjected to the alkali isomerization procedure and absorption coefficients were determined at or near the principal maxima, with a photo-electric spectrophotometer and ethanol as the solvent. Specific absorption coefficients at 2340, 2680, 3010 and 3160 Å. are given, together with coefficients at 2340 and 2680 determined with purified linolenic and linoleic acids. C.

**Hypochlorite Solutions: Oxygen Evolution.** P. Pierron. *Compt. rend.*, 1942, 215, 354-355 (through *Chem. Abstr.*, 1944, 38, 3210<sup>6</sup>). The evolution of oxygen in the dark from dilute and concentrated solutions of K, Na and Li hypochlorites at 20° and 100° was studied as a function of pH. Loss of oxygen due to evolution as gas and formation of chlorate increases with alkalinity and is greatest for the potassium and smallest for the lithium salt. In concentrated solutions decrease in pH is accompanied by decrease in loss of oxygen to a minimum at neutrality, followed by a second maximum with increased acidity. This behaviour can be explained by intermediate formation of peroxides; these can be detected. C.

**Barley Starch: Dextrinization.** K. Myrbäck and G. Stenlid. *Svensk Kem. Tid.*, 1942, 54, 103-115 (through *Chem. Zentr.*, 1943, i, 521 and *Chem. Abstr.*, 1944, 38, 3507<sup>1</sup>). The dextrinization of barley starch by amylase follows exactly the same course as previously reported for potato, corn and arrowroot starches, although these four starches differ in several respects and especially in their phosphorus content. The mechanism of starch hydrolysis is discussed. C.

**Corn Starch Linear Component: Fatty Acid Adsorption.** T. J. Schoch and C. B. Williams. *J. Amer. Chem. Soc.*, 1944, 66, 1232-1233. The adsorption of iodine by corn starch is markedly repressed by the presence of fatty acid. This effect appears to be due to preferential adsorption of fatty acid by the presumed linear component of the starch, viz., that component which is selectively precipitated by butanol and which is responsible for the blue colour with iodine. The higher fatty acids likewise act as selective precipitants for the linear-chain component of corn starch. By the treatment of a defatted corn starch paste with oleic acid the linear-chain fraction was separated as a microcrystalline floc in an amount equivalent to 29 per cent. of the original defatted corn starch. After prolonged Soxhlet extraction with methanol, its iodine affinity was 14.5 per cent. The non-precipitated fraction (presumably of branched molecular configuration) was isolated by treating the centrifugate with several volumes of methanol. After extraction with methanol, its iodine affinity was less than 0.2 per cent. Since traces of higher fatty acid will reduce the iodine adsorption, cereal starches must be exhaustively defatted before potentiometric evaluation of iodine affinity. The proportion of linear-chain component in corn starch can be determined approximately by dividing the iodine affinity of defatted corn starch by that of the repeatedly recrystallised butanol-precipitated fraction. This gives a calculated amount of 28 per cent. linear-chain component in corn starch, substantially higher than the amount previously reported by selective precipitation with butanol, but in excellent agreement with values more recently obtained by improved precipitation methods with certain of the amyl alcohols. C.

**Polysaccharides: Chemistry.** W. Z. Hassid. *Ann. Rev. Biochem.*, 1944, 13, 59-92. A review, with 110 citations, of work published during the past year or two on the structural chemistry of starch, glycogen, cellulose, the galactans, and other polysaccharides. C.

**Starch: Fine Structure.** P. Jaloveczky. *Bot. Közlemények*, 1942, 39, 601-619 (through *Schweiz. Brau. Rund.*, 1943, 54, Kart. der Brau.-Lit., 835/82, and *J. Inst. Brewing*, 1944, 50, 155-156). If dry potato- or canna starch granules are treated with a concentrated solution of ferric chloride, swelling starts at once, and is complete within 10 min. With nickelous chloride solution the action starts after 1 min., and is finished after 1 hour; with cobalt chloride solution swelling is first observed after 30 min., and whole granules can be seen on the following day. The finely-porous structure of the starch granule may be demonstrated by rapid penetration of the granule by iodine solution, followed by equally rapid decolorisation with sodium thiosulphate solution. If starch is treated with a 0.5 per cent. solution of potassium hydroxide it is possible to distinguish under



the microscope the small, clearly-defined nucleus; occasionally more than one is visible. A starch granule which has undergone a process of dry distillation develops an appreciably enlarged nucleus. Further details are given of the modifications in microscopic structure, optical properties and stratification effects which result from treatment with 1 per cent. sodium or potassium hydroxide solutions, ptyalin, 7.5 per cent. hydrochloric acid, zinc chloride solution, or from heat treatment, etc.; the appearance of the granules in polarized light is also discussed. The fine structure of the granules can also be rendered visible by treatment with dyes or with chromic acid, or, after heating in a bath of paraffin wax, with alcohol. C.

**Starch Substances: Acid Hydrolysis.** M. Samec and M. Dermelj. *Kolloid Z.*, 1942, 101, 123/126 (through *Chem. Zentr.*, 1943, i, 1274, and *Chem. Abstr.*, 1944, 38, 3507<sup>3</sup>). In the course of the acid hydrolysis of amyloamylose, erythroamylose and erythrogranulose changes in reducing power and optical activity are hardly discernible. Greater differences are observed by applying the unimolecular reaction constant to the rate of hydrolysis of maltose linkages in the maltose. C.

**Gelatin: Preparation.** W. M. Ames. *J. Soc. Chem. Ind.*, 1944, 63, 200-204. The work of various investigators on the preparation of gelatin and the influence of the type of precursor and method of extraction on the properties of the product is reviewed and a report is given of experimental studies of gelatins prepared from pigskin, sinews, ossein, and rabbit skin with different treatments. Time of extraction, yield, jelly strength, and iso-electric acidity and pH are tabulated. The data show that the gelatins fall into three groups, distinguished by the pH value at their iso-electric point, which does not depend on the type of precursor but on the pre-treatment before extraction. The iso-electric points were 6.0 for gelatin extracted with water, 8.9 for gelatin prepared by the acid process, and between 4.75 and 4.83 for the alkaline preparation. Use of acid, before or after a lime soak, did not appear to have any appreciable bearing on the extraction. All the gelatins, except those extracted with water, were of very good quality, as measured by capacity to form firm jellies. In further experiments gelatin was prepared from hide which had been soaked for different periods in milk of lime. It was found that gelatins could be prepared with iso-electric points gradually rising from an acidity of 0.24 per cent. to 1.4 per cent. or falling in pH from 6.0 to 4.77. The jelly strength and the time of extraction approximately followed the movement of the iso-electric point, the jelly strength gradually increasing and the time of extraction falling with falling pH. The yield of good gelatin also increased. These results afford an explanation of the variation in the position of the iso-electric point of commercial gelatins. In practice, extraction is carried out whenever the stage reached corresponds with good jelly strength irrespective of the position of the iso-electric point, which may fall anywhere between pH 6 and pH 4.77. C.

**Isinglass: Production.** F. G. S. Procter. *J. Inst. Brewing*, 1944, 50, 117-118. The effects of the war on the isinglass trade are discussed and the methods of preparing the different types are briefly described. C.

**Milk Casein: Composition.** G. A. Ramsdell and E. O. Whittier. *J. Biol. Chem.*, 1944, 154, 413-419. A procedure for determining the composition of casein as it exists in the caseinate-phosphate complex in milk is described which involves isolation of the complex by means of the supercentrifuge, its analysis, and calculation of the percentage content of the elements of the casein. Such a procedure avoids separation and alteration of the casein by chemical means and in consequence, prevents loss of P and S. Increase in alkalinity of the complex by the addition of neutral K oxalate indicated the presence of tricalcium phosphate rather than dicalcium phosphate in the complex. On this basis the complex was found to contain 4.80 per cent. calcium phosphate and 95.20 per cent. calcium caseinate. The latter fraction contained 1.18 per cent. Ca. A series of calcium caseinates was prepared from grain curd casein and the percentages of Ca were plotted against the pH of 3 per cent. dispersions prepared from them. The curve indicated that a caseinate of 1.18 per cent. Ca content would yield a pH of 6.40, which is only 0.07 pH more acid than the pH of the milk from which the complex was obtained. The results for the composition of casein obtained by this method check well, as a whole, with analyses of casein obtained by acid precipitation, thus indicating that the changes in physical

character through the action of acid are not accompanied by a pronounced alteration in its percentage elemental composition. C.

**Proteins and Amino Acids: Chemistry.** H. Neurath and J. P. Greenstein. *Ann. Rev. Biochem.*, 1944, **13**, 117-154. A review, with 261 citations, of recent work on (1) the preparation and identification of proteins, (2) protein hydrolysis, (3) isolation and determination of amino acids, (4) amino acid composition and distribution, (5) physical properties of proteins, (6) internal structure, and (7) denaturation. C.

**Silk Fibroin: Partial Hydrolysis.** W. H. Stein, S. Moore and M. Bergmann. *J. Biol. Chem.*, 1944, **154**, 191-201. The use of aromatic sulphonic acids as reagents for the isolation of peptides is discussed and approximate solubility products of arylsulphonates of several peptides and amino acids are tabulated. Data on the course of the hydrolysis of fibroin by concentrated hydrochloric acid at 40°, measured by nitrous acid and ninhydrin methods, are presented and discussed. The method of calculating the average peptide chain length at any given time during the hydrolysis is explained. From a partial hydrolysate containing dipeptides, glycyl-L-alanine and L-alanylglycine have been isolated by the successive use of 2:5-dibromobenzenesulphonic acid and 2:6-di-iodophenol-4-sulphonic acid. The amino acid composition of fibroin is discussed; several lines of evidence point to the probability that silk fibroin contains 30-35 per cent. of alanine. Preliminary analyses for L-tyrosine indicate a value of 11.9 per cent. C.

**Pectin Solutions: Viscosities.** H. S. Owens, H. Lotzkar, R. C. Merrill and M. Peterson. *J. Amer. Chem. Soc.*, 1944, **66**, 1178-1182. The relative viscosity of pectin solutions varies with concentration in a manner similar to that of other ionizable hydrophilic colloids and certain salts. The viscosity of dilute pectin solutions increases to a maximum as the pH is adjusted to a value near 6. The viscosity can be reduced to a minimum value by the addition of acid or sodium chloride. As the concentration of pectin is increased above 0.5 per cent., the relative viscosity is practically unaffected by changes in pH in the range of 1 to 7. Urea up to 0.5 molal concentration has little effect on the relative viscosity of pectin solutions. The relative viscosity/concentration curve follows the Arrhenius equation to a concentration of pectin of about 0.1 per cent. or more, depending upon the value for the intrinsic viscosity, when the solution is at pH 1-2 or when 0.9 per cent. or more of sodium chloride is present. This makes it possible to calculate values for the intrinsic viscosity which may have some relationship to the molecular weight. The viscosity/concentration curves for the pectinates of sodium, trimethylammonium, ethylenediammonium, 2:2-dihydroxymethylpropylammonium, and tetraethylammonium ions are practically identical. Changing the temperature from 0-50° has little influence on the relative viscosity of pectin solutions at concentrations below 0.05 per cent. Above that concentration the relative viscosity decreases with increase in temperature. Tentative explanations of these results are discussed. C.

**Macromolecules: Structural Analysis.** R. Lepsius. *Kunststoffe*, 1943, **33**, 133-138 (through *Chem. Abstr.*, 1944, **38**, 3183<sup>g</sup>). Physical methods of investigating the structure of high polymers are surveyed. Examples are given of the application of X-ray methods, Raman spectroscopy, ultra-microscopy, streaming birefringence, polarised light, electron microscopy, and ultrasonic waves. C.

**Oxidation-Reduction Potentials: Significance and Applications.** H. I. Stonehill. *J. Soc. Dyers & Col.*, 1944, **60**, 176-183. The significance of oxidation-reduction potentials is explained, methods of determining standard redox potentials are described, and applications to analysis, potentiometric redox titrations, redox indicators, the pH value of a redox solution, and miscellaneous applications of redox potentials are discussed. C.

**Hemicellulose: Photometric Determination.** C. J. Barton and A. J. Prutton. *Ind. Eng. Chem., Anal. Edn.*, 1944, **16**, 429-430. For the determination of hemicellulose dissolved in sodium hydroxide solution, K dichromate solution is added and the solution is acidified with concentrated sulphuric acid, boiled for about 30 sec. and then cooled. The transmittance at 600 mμ is measured and the hemicellulose concentration is determined from calibration curves based on iodometric determinations of hemicellulose concentration. Experimental details and transmittance curves are given. C.

**Physico-chemical Studies on the Water-soluble Fraction of Powdered Wool.** T. U. Marron and J. I. Routh. *Archives of Biochem.*, 1944, 4, 319-332. Aqueous extracts of wool which had been ground for varying lengths of time in a steel ball mill were studied with respect to the physical and chemical nature of the resulting soluble fraction. Precipitation data showed that only relatively few of the soluble particles were large enough to be precipitated by trichloroacetic acid. Tungstic acid removed less than half the biuret nitrogen from solution. The different fractions obtained on electrophoresis were characterised by variations in acidity, in biuret and tyrosine nitrogen content, and a change in response to the above protein precipitants. Polarographic studies indicated the heterogeneous nature of the soluble material. The polarographically active material accumulated in the electrophoresis cells at pH 3 and contained the major portion of the precipitable nitrogen. W.

**Wool: Structure and Reactivity.** A. Schöberl. *Forsch.-Ber. Zellwolle-u. Kunstseide-Rings*. G.m.b.H., 1941, No. 1, 283-287 (through *Chem. Zentr.*, 1942, II, 2327 and *Chem. Abs.*, 1944, 38, 3137). Wool of uniform grade contained cystine 10.78, dicarboxylic acids 28.98 and hexonic bases 15.62 per cent. by wt. As compared with the results of Elöd, Nowotny and Zahn (these *Abs.*, 1941, A601), wool treated for 8 days with water of 80° and mercury still contained 54 per cent. of the original cystine. The heavy metals are indicators for the hydrogen sulphide evolution from wool by the action of hot water. Wool can be coloured intensively and uniformly yellow by treatment at 80° with water containing cadmium. The fibre can be coloured black by means of metallic lead or iron. These metals are better than mercury for producing colour effects and form metallic sulphides more quickly on the surface of the fibre. Elöd, Nowotny and Zahn have not disproved the significance of sulphur for the strength and properties of the wool fibre. W.

## 10—ECONOMICS

**Chinese Textile Industries: Reconstruction.** Cha Chi-Min. *Textile World*, 1944, 94, No. 6, 85-87, 182-184. In 1937 the Chinese textile industry had 5 million spindles, 100,000 looms, and bleaching, dyeing, printing, finishing and knitting plant, all of modern types. About 60 per cent. of the spinning and weaving was under the sole control of Chinese people and the rest was almost all in Japanese hands. About 90 per cent. of the industry is now destroyed. Future prospects are reviewed and a Five-years Plan for rebuilding the industry with the help of American plant and money is discussed. C.

**Bombay Cotton Wages, 1914-1919 and 1939-1943.** *Indian Textile J.*, 1944, 54, 356-357. Available statistics are analysed in a comparison of cost of living and wage trends during the two World War periods. In both periods the great rise in costs occurred in the fourth year, but the operative is in a much better position now than in 1919, because wages and bonuses have not lagged so far behind. There have been much greater rises in the index for costs and wages in India than in England since 1942. C.

**Surat Weaving Industry: Organisation.** M. C. Munshi. *Indian Textile J.*, 1944, 54, 352-355. A brief history is given of the weaving industry of Surat from the early 16th century. In 1682 the export of cotton fabrics was 1,436,000 pieces. A characteristic feature in modern times is the large number of small establishments with about 3-5 power looms each. In 1942-43 a survey of 649 such places accounted for 4,108 looms, of which 3,645 were power looms, including many by Hattersley. The author discusses the reactions of this kind of establishment both on the hand-loom industry and on the large mills. C.

## 11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY AND EDUCATION

**American Cotton Operatives: Employment on Three Shifts.** *Textile World*, 1944, 94, No. 6, 92-94. A number of opinions on working a third shift in American mills are reported. It appears to be general practice to use the third shift as a training ground for workers who are being prepared for promotion, but it is believed in many quarters that production would not suffer if the third shift were abandoned and the first and second shifts worked more efficiently. C.

**Cotton Spinners: Training.** Nell Woodward. *Cotton (U.S.)*, 1944, 108, No. 7, 89-91. An account is given of the experiences of an American university woman in learning the work of a spinner in order to train recruits. She emphasises (1) the bad tendency of old employees to discourage learners, and hence the value of using trained instructors, (2) the difficulty of imparting the names for machine parts and spinning products, and (3) the importance of persuading operatives to take adequate meals. C.

**Weaver's Wage: Calculation on Time-study Basis.** W. M. Fanning. *Textile World*, 1944, 94, No. 7, 51-55. The writer holds that wage incentives to increase production will be assisted if the wage system is based on accurate knowledge of the working conditions derived from time studies. The essential feature is to calculate the "standard minute" for a job, that is the amount of work done in one minute by the "standard operative." Thus, from observations of loom stops it is calculated that a weaver on looms running at 160 r.p.m. and 85 per cent. efficiency, should put in 0.31 standard-minutes per 1,000 picks. Her actual pick reading (from the clock) would then give her "standard time"; e.g. if she put in 2,077 picks in the 8-hour shift she would be credited with  $2077 \times 0.31 = 10.73$  hours. To this would be added compensation for loom idleness for which she was not responsible, say, 0.13 hour. At the basic rate of 63 cents her wage would then work out at  $(10.73 + 0.13) \times 63$  cents = 6.85 dollars. The same figure of 0.31 standard-minutes per 1,000 picks would also be used to calculate how many looms to assign to a weaver to give her the chance to earn more, say one-third more, that is to put in 80 standard-minutes per hour. Thus, supposing she runs looms at 160 r.p.m. and achieves an efficiency of 90 per cent. she would put in  $160 \times 60 \times 0.9 = 8.64$  thousand picks per loom-hour and could manage  $80 / (8.64 \times 0.31) = 30$  looms to secure one-third above the basic pay. Such reasoning is set out in detail for (a) "calculating a weaver's job," (b) battery-hand assignment and (c) the tackler's assignment. Thus, under (b) the job of replenishing bobbins is calculated to take 0.113 standard-minutes per bobbin, and under (c) the "standard minute" for loom tackling is 0.800 per loom-hour. C.

**Chlorovinyl Resins: Toxic Effects and Conditions of Use.** N. M. Pietropavlovsky. *Gigiena i Zdorov'e*, Moscow, 1942, No. 10, 14-20 (through *Bull. Hygiene*, 1944, 19, 450-451). It is believed that exposure for 3 minutes to an atmosphere containing 64 mg. of vinyl chloride causes in man giddiness, loss of orientation and headache, which lasts for about  $1\frac{1}{2}$  hours after return to the fresh air. White mice exposed to vapours from heated samples of vinyl resins containing about 53.7 per cent. chlorine showed (1) irritation of the visible mucous membranes, (2) hyperæmia of the extremities, ears and tails, (3) disturbances of coordination movements and disappearance of reflexes, (4) death from respiratory failure, sometimes with convulsions of the extremities and head. A post-mortem examination showed irritation of the respiratory tract, considerable oedema and necrosis of the tissues and degeneration in the liver, kidneys and heart. The main toxic substance was hydrochloric acid. To ensure hygienic conditions in the use of such resins it is essential that the decomposition temperature should be 20° higher than the maximum temperature reached in manufacturing processes. The heating of mixtures should be regulated by safety devices. A good local ventilation is essential. Medical supervision of all workers must be compulsory; personal hygiene must not be neglected. C.

**American Textile Schools: Organisation for Textile Research.** M. E. Campbell. *Amer. Dyes. Rept.*, 1944, 33, 313-315. Textile research in textile schools is discussed and it is pointed out that, although only a small proportion of the students will take up research work, a school should endeavour to acquaint all its students with the possibilities and limitations of the tools of textile research, with the most modern methods of analysing and interpreting the results of research, and with the identity, scope and objectives of the different organisations conducting textile research. An account is given of the staff, equipment, facilities and advantages for research of the Textile School at North Carolina State College. The two general types of research, fundamental and applied, are briefly discussed, and it is suggested that, in general, the greatest returns from research can be expected in a textile school if the programme centres around the application of principles to commercial production. The financing of research at a textile school is briefly discussed. C.

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2,323,843	A19	2,326,233	A109	2,329,663	A157	2,332,369	A264	2,335,142	A339
2,323,855	A11	2,326,307	A98	2,329,664	A157	2,332,373	A241	2,335,154	A354
2,323,879	A6	2,326,605	A109	2,329,704	A189	2,332,375	A235	2,335,222	A347
2,323,882	A8	2,326,769	A98	2,329,705	A189	2,332,413	A233	2,335,447	A347
2,323,987	A8	2,326,772	A117	2,329,706	A189	2,332,485	A233	2,335,483	A339
2,323,988	A11	2,326,828	A117	2,329,717	A189	2,332,501	A250	2,335,516	A360
2,323,991	A8	2,326,829	A117	2,329,718	A189	2,332,738	A241	2,335,517	A360
2,323,998	A11	2,326,830	A117	2,329,730	A189	2,332,783	A233	2,335,518	A360
2,324,035	A11	2,326,831	A93	2,329,738	A194	2,332,817	A250	2,335,534	A339
2,324,036	A12	2,326,832	A93	2,329,739	A194	2,332,826	A233	2,335,563	A339
2,324,097	A19	2,326,833	A93	2,329,741	A224	2,332,833	A236	2,335,564	A339
2,324,220	A12	2,326,834	A93	2,329,742	A194	2,332,848	A250	2,335,566	A337
2,324,256	A12	2,326,862	A98	2,329,743	A202	2,332,849	A250	2,335,576	A336
2,324,437	A6	2,326,863	A98	2,329,744	A202	2,332,889	A241	2,335,582	A347
2,324,442	A12	2,326,905	A99	2,329,745	A207	2,332,890	A236	2,335,592	A336
2,324,539	A8	2,326,950	A121	2,329,771	A194	2,333,069	A236	2,335,654	A339
2,324,564	A12	2,326,979	A93	2,329,999	A194	2,333,074	A241	2,335,702	A347
2,324,565	A12	2,327,087	A92	2,330,212	A194	2,333,160	A250	2,335,739	A347
2,324,567	A6	2,327,160	A109	2,330,263	A202	2,333,203	A251	2,335,880	A339
2,324,584	A12	2,327,182	A117	2,330,269	A194	2,333,204	A251	2,335,905	A347
2,324,601	A12	2,327,183	A117	2,330,441	A202	2,333,206	A264	2,335,965	A339
2,324,611	A12	2,327,199	A109	2,330,445	A194	2,333,267	A236	2,335,975	A339
2,324,612	A12	2,327,250	A109	2,330,494	A190	2,333,278	A233	2,335,979	A339
2,324,645	A108	2,327,278	A99	2,330,514	A194	2,333,279	A233	2,335,980	A336
2,324,740	A108	2,327,323	A121	2,330,519	A194	2,333,340	A241	2,336,019	A336
2,324,752	A97	2,327,349	A93	2,330,537	A190	2,333,377	A241	2,336,086	A347
2,324,787	A93	2,327,356	A99	2,330,645	A195	2,333,381	A251	2,336,087	A347
2,324,838	A97	2,327,397	A134	2,330,681	A195	2,333,382	A251	2,336,113	A379
2,324,887	A91	2,327,399	A92	2,330,683	A195	2,333,384	A251	2,336,118	A383
2,324,897	A115	2,327,413	A109	2,330,775	A202	2,333,413	A241	2,336,159	A379
2,324,917	A117	2,327,460	A92	2,330,998	A202	2,333,443	A259	2,336,187	A383
2,324,949	A97	2,327,516	A92	2,331,004	A195	2,333,444	A233	2,336,193	A380
2,324,989	A93	2,327,540	A109	2,331,042	A202	2,333,527	A264	2,336,230	A388
2,325,023	A97	2,327,712	A110	2,331,090	A202	2,333,535	A241	2,336,252	A399
2,325,026	A115	2,327,747	A99	2,331,095	A202	2,333,572	A251	2,336,255	A383
2,325,027	A115	2,327,756	A99	2,331,200	A190	2,333,623	A251	2,336,265	A388
2,325,060	A91	2,327,760	A110	2,331,207	A195	2,333,630	A241	2,336,266	A388
2,325,061	A121	2,327,770	A92	2,331,289	A195	2,333,667	A293	2,336,267	A388
2,325,078	A97	2,327,784	A156	2,331,290	A195	2,333,755	A288	2,336,320	A383
2,325,096	A97	2,327,987	A147	2,331,321	A202	2,333,770	A293	2,336,321	A383
2,325,127	A97	2,327,988	A147	2,331,328	A202	2,333,846	A293	2,336,340	A388
2,325,129	A98	2,328,063	A156	2,331,329	A202	2,333,870	A293	2,336,341	A388
2,325,147	A91	2,328,074	A141	2,331,330	A202	2,333,882	A293	2,336,343	A384
2,325,153	A91	2,328,125	A141	2,331,423	A189	2,333,897	A293	2,336,365	A388
2,325,159	A93	2,328,307	A141	2,331,454	A195	2,333,904	A293	2,336,455	A384
2,325,183	A91	2,328,324	A144	2,331,469	A224	2,333,916	A304	2,336,456	A395
2,325,187	A98	2,328,335	A147	2,331,528	A195	2,333,917	A304	2,336,481	A379
2,325,208	A98	2,328,431	A156	2,331,579	A203	2,333,965	A285	2,336,591	A384
2,325,215	A98	2,328,481	A156	2,331,611	A190	2,334,058	A294	2,336,593	A381
2,325,250	A134	2,328,537	A183	2,331,664	A195	2,334,066	A304	2,336,743	A379

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2,336,745	A380	2,337,211	A412	2,337,977	A412	2,338,386	A471	2,338,587	A472
2,336,876	A384	2,337,357	A412	2,337,986	A413	2,338,391	A472	2,338,610	A464
2,336,937	A384	2,337,431	A412	2,338,085	A463	2,338,394	A463	2,338,619	A460
2,337,068	A406	2,337,438	A412	2,338,167	A471	2,338,443	A457	2,338,633	A464
2,337,102	A411	2,337,652	A423	2,338,196	A457	2,338,473	A457	2,338,638	A464
2,337,129	A412	2,337,664	A406	2,338,243	A471	2,338,490	A472	2,338,641	A457
2,337,153	A412	2,337,770	A412	2,338,252	A471	2,338,513	A463	2,338,656	A460
2,337,187	A412	2,337,896	A412						

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712,507	A49	725,794	A251	51,815	A142	117,278	A68	407,228	A251
715,441	A458	727,153	A251			117,933	A423	412,702	A68
716,599	A423	727,568	A251			118,223	A423	412,891	A156
720,680	A157	728,673	A347					415,273	A388
721,343	A68	731,577	A347						
721,885	A157	731,682	A336						
722,122	A157	731,871	A347						
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## ERRATUM.

P. A12 and p. A99. \*The title and author's name omitted from the first abstract in Section 4 on p. 12 appear on p. 99.

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STANDARDISATION AND INDEX



# THE JOURNAL OF THE TEXTILE INSTITUTE

## STANDARDISATION

### MEASUREMENT OF CLOTH THICKNESS

The importance of being able to measure the thickness of textile fabrics in a reliable manner has become increasingly evident as their application to, and design for service have been developed. It has also been apparent to those called upon to exercise such control that various engineers' instruments such as micrometer screw gauges and dial gauges may give widely different results on the same material. The discrepancies arise very largely from one source—the relative ease of compression of textile materials as compared with those of the mechanical engineer. It is therefore necessary to control carefully the pressure applied to the specimens to be tested for thickness. For this and other reasons arising from their peculiar properties, a standard method of measuring the thickness of textile fabrics is essential.

The present draft is not intended to provide a method applicable to all textile materials for all purposes. There are some constructions whose utility lies in possessing well defined thickness at low pressures. For these and other materials not sufficiently characterised by measurements within the pressure range of 1 to 10 lb. per sq. in., other methods and apparatus must be employed. There is, however, a very large bulk of cloths for which the present draft method is appropriate, including many of the wide range of mechanical and electrical fabrics.

Existing specifications and experience have provided the necessary information for this draft. It is therefore a conservative document. No special development work has been required, to arrive at any particular features, and it is confidently expected that there will be agreement between users of the method. It is important to observe that the method is essentially one for the laboratory. The gauge needs reasonably careful handling and the apparatus requires to be set up on a firm base so that the anvil is horizontal. This at once precludes its use as a portable pocket instrument. For works and other routine control purposes, where it may not be possible to use the apparatus described by this specification, secondary measuring devices will have to be used. These can, of course, be compared against the standard instrument for a given material. It may be that there is room also for a specification which will control the essential features of a thickness gauge for fabrics, which can be held in the hand, but the drafting committee favours the opinion that the adoption of the present proposal will be a sufficient advance for the present.

Explanations of some features of the instrument may be desirable. The choice of a dial gauge, rather than a micrometer screw gauge, is dictated by practical experience and the difficulty of obtaining concordant results with the latter type of instrument. Moreover, the pressure applied, even by ratchet type gauges, is actually high as well as variable; British practice (B.S.S.870) allows a range of  $1\frac{1}{4}$  to  $1\frac{3}{4}$  lb., which is equivalent to  $25\frac{1}{2}$  to  $37\frac{1}{2}$  lb. per sq. in.

The range of pressure 1 to 10 lb. per sq. in. over which it is intended that measurements shall be possible by this instrument, is determined by a variety of considerations. There is a lower limit to the pressure: the weight of the plunger assembly is such that the calculated pressure cannot be brought much below 1 lb. per sq. in. This is therefore a convenient minimum. The upper limit is decided by considerations of safety. The plunger and associated parts will sustain a considerable dead-weight load without appreciable distortion,

but it is essential that the load shall be truly axial and that no shocks be applied. The safe load, allowing for normal care in handling, should be well below the theoretically safe steady load, and it is considered that loading so as to give 10 lb. per sq. in. is a suitable maximum for ordinary purposes. Exceptionally, if special care is exercised, pressures of the order of 25 lb. per sq. in. may be used.

The choice of working pressure is to a large extent arbitrary. There are no over-riding considerations which would necessitate a single exact value for all fabrics for which this method of measurement is appropriate. This is reflected in the variety of pressures required by different extant specifications. Whilst it is considered to be desirable that the same pressure should be used for similar fabrics, the choice of pressure has been left to the material specification.

The task of the drafting committee was considerably lightened by the existence of B.S.S. No. 907 (1940) which deals with dial gauges for linear measurements. For general purposes the type described in Table No. 3 of that specification, having 40 or 50 divisions of 0.001 in. round a dial of  $1\frac{3}{4}$  in. to 2 in. diameter is considered suitable; but in exceptional cases the material specification may prescribe the more sensitive type having 100 divisions of 0.0001 in. round the dial.

It will be found that a variety of instrumental details do not appear in this draft. These are left to the discretion of the user and instrument maker. For example, the depth of throat may be less for a user concerned entirely with narrow fabrics. The form of the table surrounding and level with the anvil is a matter of individual convenience. To the instrument maker is left the form of the dead weights and the mode of setting them axially over the plunger: it is only necessary that they shall be readily seated and removed without jarring the gauge.

It is recognised that some care is required in the use of an instrument of this kind. Various proposals have been made to render the operation less subjective, such as the use of auxiliary gradual loading devices and standard lapse periods. It is considered, however, that the procedure laid down in the present draft will be adequate for all except a few materials, and special procedures for these can be prescribed as they arise.

## **TENTATIVE TEXTILE STANDARD No. 9, 1944**

### **METHOD OF MEASURING CLOTH THICKNESS**

**Under Loads of 1 to 10 lb. per sq. in.**

#### **Part I—The Instrument**

##### **General**

The instrument shall consist of a dial type gauge mounted vertically on a frame which is provided with an anvil below the foot of the gauge. The instrument shall also be provided with a table for supporting the fabric during thickness measurement. This shall consist of a smooth, plane, horizontal surface, surrounding the anvil and level with it, and of sufficient size to prevent any error in the measurement through bending of the specimen. The table may conveniently constitute part of the base of the frame.

##### **Specification**

(1) The gauge shall conform with the provisions of British Standard Specification No. 907—Class 1, except that the main return spring and back lug shall be omitted. It shall be fitted with a revolution counter, and rotatable bezel by means of which the instrument can be adjusted to read zero.

(2) Unless otherwise prescribed by the material specification, the gauge shall have 40 or 50 divisions of 0.001 in. round the dial. (See table No. 3 B.S.S. No. 907).

It is recommended that when a more sensitive type is considered to be necessary, the gauge shall have 100 divisions of 0.0001 in. round the dial. (See table No. 5 B.S.S. No. 907).



## *Method of Measuring Cloth Thickness—Part II*

(3) The gauge shall be provided with a foot having a hardened, polished, plane, circular face of  $0.375 \text{ in.} \pm 0.001 \text{ in.}$  diameter rigidly fixed to the plunger.

(4) The plunger shall have fixed axial deadweight loading such that the calculated pressure over the foot shall be  $1 \text{ lb. per sq. in.}$  when the dial reads zero. This requires a total deadweight of  $50.1 \text{ g. (0.110 lb.)}$ , including the plunger and foot, with a correction for the tension of the backlash spring.

For loadings which will give pressures greater than  $1 \text{ lb. per sq. in.}$  the loading shall continue to be axial.

This may be attained by any acceptable means, one satisfactory method being the provision of a platform. The platform shall form part of the fixed deadweight loading, and shall be rigidly fixed at the top of the plunger, and shall be provided with means for seating cylindrical weights which will increase the calculated pressure over the foot to a maximum of  $10 \text{ lb. per sq. in.}$

(5) The spring which is necessary to prevent backlash in the gauge shall not produce a change of pressure greater than  $0.1 \text{ lb. per sq. in.}$  (=load difference of  $5 \text{ g. or } 0.011 \text{ lb.}$ ) for a plunger movement of  $0.1 \text{ in.}$

(6) The gauge shall be fitted with a lever for raising and lowering the plunger so that contact with the material to be measured can be effected gently.

(7) The anvil shall be rigidly set in the frame and shall have a hardened, polished, plane, circular face of  $0.375 \text{ in.} \pm 0.001 \text{ in.}$  diameter.

(8) The surfaces of the foot of the gauge and anvil shall be co-axial and shall be parallel to within  $1/5000 \text{ in.}$  when tested by a feeler gauge at the edges.

(9) The gauge shall be rigidly fixed to an arm which shall be integral with the base of the frame.

(10) The plunger shall move perpendicularly to the face of the anvil.

(11) The rigidity of the frame shall be such that a load of  $1 \text{ lb.}$  applied to the dial housing, out of contact with the plunger, does not produce a deflection greater than  $0.0001 \text{ in.}$  as indicated on the micrometer dial.

## **Part II—Testing Technique**

### **Procedure**

(1) The instrument shall be set on a firm base so that the anvil is horizontal.

(2) The instrument shall be loaded so as to provide the pressure prescribed by the material specification.

(3) The surfaces of the anvil and foot shall be cleaned by placing a clean, smooth sheet of paper between them and withdrawing it, and the gauge shall then be made to read zero by the use of the adjustable bezel.

(4) The fabric shall be conditioned in the standard atmosphere (see B.S.S. No. 1051) in the loose state, for 24 hours, and the thickness measurement made under the same condition, unless contrary instructions are given in the material specification.

(5) The specimen of fabric shall be placed on the anvil in a single layer, flat and without tension. The foot of the gauge shall be lowered gently upon the fabric at a rate of about  $2/1000 \text{ in. per second}$ , and the reading taken immediately the easily visible movement of the pointer has ceased, unless contrary instructions are given.

### **Sampling and Numbering of Tests**

The number of samples to be tested and the manner of their selection shall be prescribed by the specification. In the absence of other instructions it is recommended that 10 places uniformly and randomly distributed over the specimen, but excluding selvages, shall be measured on any single specimen of material.

### **Criteria**

The material specification may prescribe the manner in which the results of the tests shall be examined; otherwise the mean value of the results shall be calculated.

## THE TESTING OF NARROW FABRICS

Towards the end of 1943 the Textile Institute received a request from the Narrow Fabrics Directorate of the Ministry of Supply for assistance in the preparation of recommendations for a series of standard testing methods, having particular reference to narrow fabrics. The wide range of application of narrow fabrics and the varied nature of their requirements had led to the existence of a great variety and multiplicity of methods of testing, and it was considered that the confusion and misunderstanding occurring in such circumstances could be avoided by the adoption of a system of unified methods of test.

The present proposals represent a step towards standardisation of testing methods for this class of materials. They are tentative recommendations, issued with the primary object of fulfilling practical war-time needs. The adoption of definite standards, for general peace-time purposes must necessarily be postponed until later deliberations of a more comprehensive and representative nature than have been attainable in present circumstances can be undertaken.

The recommendations have been prepared by a number of specialised technical committees appointed to deal with different groups of tests, and the decisions have been achieved largely through the medium of discussion, in the light of existing knowledge and experience. As was to be expected, however, in work of such extended scope, and in the present state of knowledge, investigations of a practical kind were necessary for several of the tests before a satisfactory procedure could be recommended. In the time available the experimental work has been necessarily limited, but it is considered that sufficient has been done to indicate the most suitable methods of test, and to make the range of tests comprehensive. It is left to the compilers of specifications to deal with any exceptional requirements and to prescribe modified or entirely different methods of test where necessary.

The tests are classified under four main types to facilitate reference. Part I comprises the general dimensional and physical properties. The tests have been drafted with special reference to narrow fabrics and certain recommendations are made with regard to details of apparatus and methods of testing which have been proved essential in practice. When the measurement of thickness was considered it seemed desirable to separate the description of the instrument and method of test from the main specification and accordingly Tentative Textile Standard No. 9, 1944, was drafted. The recommendations for machine capacity and rate of traverse in strength testing follow from the work of Technical Committee "A" of the Institute's Standardisation Scheme.<sup>1</sup> Methods of assessing bow and curl are given in order that these properties may be fully defined when necessary.

Part II contains a series of tests intended to provide a measure of the behaviour of elastic fabrics.<sup>2</sup> Methods of testing have been included which are designed to reproduce effects in the material approximating to those of actual conditions of use. This may be especially important in view of the impending greater use of synthetic rubber thread as a constituent of these fabrics. Notes on the issues involved in testing are inserted in the text where necessary.

Part III deals with chemical tests. For many of the tests in this section it has been necessary to include descriptive matter of greater length in order adequately to cover the testing operations, the apparatus and relevant issues. It is left to the material specification to prescribe the appropriate tests to be applied, also the manner of sampling the material, and the values by which the performance of bulk quantities of fabric shall be judged.

Part IV comprises the tests for colour fastness. The material specification should prescribe the appropriate tests to be applied where colour fastness is an important requirement of the fabric.

The majority of the tests, especially those in parts I and II have their texts arranged under one or more of a series of headings:—

## *Testing of Narrow Fabrics*

Under "General" the nature of the property to be assessed by the test is explained.

"Designation" covers the definition of the property to be measured by the test.

The "Units" by which the property shall be measured are also given where necessary.

Under "Testing Procedure" an outline is given of the practical operations, with attention to the arbitrary features of machines, technique and preparation of specimens.

In addition, it has been considered important to make some reference to other factors involved in the interpretation of the results of testing, and in the formation of representative judgments of fabric in bulk quantities. These can be considered under three headings:—

"Criteria" represents the choice of mean, maximum, minimum or range, etc., for the values given in the material specification; and the method of computing the results of testing for assessing their compliance with the specified values. The choice depends not only on the nature of the test but also on the intended use of the material.

Under the heading of "Performance" the material specification will usually prescribe the results to be shown by a satisfactory material in accordance with the given criteria. In appropriate instances, such as the mean of quantitative results, tolerances or limits should also be prescribed.

"Sampling and number of tests" includes the size of a sample and the manner of its selection from a consignment or other bulk quantity of material, the number of specimens to be tested from the material sample and the manner in which they should be taken. It is, of course, well known that the size and mode of selection of a sample should depend on the size of the bulk, on the variability of the material, on the kind of test and on the information which it is desired to obtain. For some tests it has not been found possible to give any guidance in this matter and it is left to the material specification to supply the necessary information. However, for some well established tests on certain types of materials, recommendations are made regarding the minimum size of a sample, and the number of tests to be carried out on such a sample, for a single determination of the property under test. This has been termed a unit sample. It is left to the specification to prescribe the relationship between the size of a consignment and the number of unit samples which should be tested. It will be noted that the recommended unit sample is of uniform size for certain groups of tests so that economy of material, time and labour is effected by using the same specimens for the various tests.

There is, of course, no question of prescribing a general method of sampling. The unit sample system would be less useful, for instance, in cases where the variation of a particular property may be identifiable, and where a scheme of sampling more closely related to the known causes of variation could be adopted; or in cases where certain characteristics were to be judged by high percentage inspection. The use of the unit sample system would be limited normally to ordinary cotton fabrics and those of similar variability and in the absence of other determining factors, though the scope of its application could be fairly extensive in narrow fabrics.

It is desirable that, when possible, all classes of testing of textile materials in bulk should be applied according to a design or plan broadly conforming to the principles of control outlined above. In the case of narrow fabrics this aspect of testing is of particular significance as variation of properties can be a relatively more serious matter than with most types of wider fabric.

Thanks are due to all who have contributed to the formulation of this series of tests; to the Society of Dyers and Colourists for its work in the preparation of the section on colour fastness; to the technical officers of Government Inspectorates; and particularly to the members of the eight technical sub-committees.

Acknowledgment is also due for the permission of the Textile Rot Proofing Panel of the Ministry of Supply to publish the tests in the chemical section dealing with iron, chromium, copper, zinc, manganese, paranitrophenol, Shirilan and pentachlorophenol. These tests are adapted from unpublished work carried out at the Shirley Institute and will form the subjects of future publications from that Institute.

Comments on the document or any part of it will be welcomed. They should be addressed to the Acting General Secretary, 16, St. Mary's Parsonage, Manchester, 3.

#### REFERENCES

- <sup>1</sup> "Cloth Strength Testing." Series of papers, I to VIII. *J. Text. Inst.*, 1942, 33, S7-S40 and S53-S62.
- <sup>2</sup> G. H. Lunge. "Some Observations on the Measurement of Stretch of Elastic Webbing." *J. Text. Inst.*, 1944, 35, T7-T16.



## Part I

### THE GENERAL DIMENSIONAL AND PHYSICAL PROPERTIES OF NARROW FABRICS

#### 1. CONDITION

##### Definition

The standard atmosphere for the conditioning of fabric samples for testing shall be as defined in British Standard Specification No. 1051, viz.:—

“ The conditions of an atmosphere at normal pressure denoted by a relative humidity of 65 per cent.  $\pm$  1 per cent. and a temperature of 70° F.  $\pm$  2° F.”

#### 2. DELIVERY CONDITION OF CONSIGNMENTS

##### General

The chief object in specifying the condition of fabric in the bulk consignment, when delivered, is that reasonable precautions shall be observed to ensure that no excessive amount of moisture is present in the fabric, as this might result in mildew and other forms of deterioration of the fabric during storage.

##### Testing Procedure

Samples of fabric taken from rolls selected from the consignment shall be weighed either immediately in the room where the goods are, or if this is inconvenient, they shall be transferred immediately to air-tight containers of known tare, which shall be weighed subsequently before the samples are removed for conditioning.

The samples shall then be conditioned in the standard atmosphere for 24 hours, and again weighed.

The accuracy of the weighing shall be of the order of 0.1 per cent. of the weight of the samples.

##### Sampling

The samples of fabric for this test shall be taken in such a manner that they are truly representative of the moisture condition of the consignment.

##### Performance

The material specification shall prescribe the maximum loss in weight as a result of conditioning.

In the absence of other determining considerations it is recommended that the loss in weight shall not exceed:

- 1 per cent. for materials composed of cotton, flax, acetate rayon, nylon, and other fibres having regains of similar order.
- 2 per cent. for materials composed of silk, hemp, wool, mohair, jute, viscose and cuprammonium rayons, and other fibres having regains of similar order.

#### 3. CONDITIONING AND PREPARATION OF SAMPLES FOR TESTING (Other than Delivery Condition)

##### (a) Fabrics (except elastic fabrics)

Specimens of fabric as required for the various tests, shall be prepared from samples which have been allowed to relax and condition in the standard atmosphere for 24 hours, and the tests shall then be carried out under the same condition.

If the specimens are required to be of definite length they shall then be marked to the requisite degree of accuracy with the aid of a steel rule.

In case of dispute and also when the samples lose more than the prescribed weight after conditioning as above, they shall first be dried in an atmosphere having a relative humidity of between 25 per cent. and 45 per cent., and a temperature not exceeding 40° C. (104° F.) and then re-conditioned in the standard atmosphere for 24 hours.

**(b) Yarns (except rubber thread)**

Packages of yarn (cheeses, hanks, etc.) from which specimens are to be taken for the purpose of any of the tests, shall be conditioned as described for fabrics in Method No. 3(a), unless contrary instructions are given in the specification.

Yarns extracted from fabric for the purpose of cloth analysis, etc., shall be taken from samples which have been conditioned and prepared as described in Method No. 3(a).

Yarns shall be measured after applying only just sufficient tension to remove crimp.

**4. TESTING OF FABRIC IN THE WET STATE**

It is recommended that wet tests shall be carried out only when the results so obtained are immediately relevant to the use of the material.

The conditions of wetting shall be so defined that reproducible results shall be obtainable.

**5. LENGTH****(a) Bulk Inspection**

The fabric shall be unrolled and drawn across a smooth, flat measuring table, preferably 5 yards long.

No more tension shall be applied to the fabric than is necessary to make it lie straight and flat.

The above procedure will normally be carried out under ordinary room conditions. In all cases of doubt or dispute the following method shall be employed:—

**(b) Testing**

The fabric shall be conditioned in the standard atmosphere, in the loose, unrolled state, for 24 hours, and the measurement, as described above, then conducted under the same condition.

**Sampling and Number of Tests**

A unit sample for either of the above methods shall consist of 5 rolls of fabric, and all shall be measured.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

**6. WEIGHT PER UNIT LENGTH****Units**

The weight per unit length shall be expressed in pounds and decimals of a pound, per gross yards.

**(a) Bulk Inspection**

The weight shall be taken of fabric which has been measured by Method No. 5(a) or (b), and the weight per gross yards calculated.

Alternatively the following method shall be used:—

**(b) Testing**

Short lengths of fabric shall be prepared from conditioned samples [see Method No. 3(a)] and these shall then be weighed to a suitable degree of accuracy, and the weight per gross yards calculated.

**Sampling and Number of Tests**

For the bulk inspection method a unit sample shall consist of 5 rolls of fabric and all shall be measured and weighed.

For testing, a unit sample shall consist of 5 lengths of two yards each; one from each of 5 rolls.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

## 7. WIDTH

### Units

The width of the fabric shall be measured in inches and fractions of an inch.

### (a) Bulk Inspection

The width shall be measured with a suitably graduated steel rule, and no more tension or pressure shall be applied to the fabric than is necessary to make it lie straight and flat.

The above procedure will normally be carried out under ordinary room conditions. In all cases of doubt or dispute the following method shall be employed:—

### (b) Testing

The fabric shall be conditioned in the standard atmosphere, in the loose, unrolled state, for 24 hours, and the width measurements then conducted under the same condition.

### Sampling, and Number of Tests

The material specification shall prescribe whether width measurement is to be carried out on the whole or a portion of the consignment, or on a unit sample, or number of unit samples.

In the absence of other determining considerations it is recommended that a unit sample shall consist of 5 rolls, and 5 measurements shall be made on each roll at randomly selected places.

### Criteria

The material specification shall prescribe whether the results shall conform to demands of maximum, minimum or mean width.

### Performance

The permissible limits of width shall be specified.

## 8. THICKNESS

### Units

Thickness shall be measured in mils. (Thousandths of an inch.)

### Testing Procedure

The fabric specimens for this test shall be conditioned and prepared as described in Method No. 3(a).

Thickness shall be measured by means of a dial micrometer. The construction of the instrument and the technique of the test shall be in accordance with Tentative Textile Standard No. 9.

### Sampling and Number of Tests

A unit sample shall consist of 5 lengths of 2 yards each; one from each of 5 rolls, and two measurements shall be made on each specimen.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

### Criteria

The material specification shall prescribe whether the results shall conform to demands of maximum, minimum or mean thickness.

### Pressure

The material specification shall prescribe the pressure under which the measurements are to be made.

### Performance

The permissible limits of thickness shall be specified.

## 9 (a). TENSILE STRENGTH—YARNS (SINGLE THREAD)

### Units

Breaking strength shall be specified in pounds and decimals of a pound.



**Testing**

The following conditions shall be observed:—

An approved testing machine shall be used with a working rate of traverse of 12 in. per minute.

The free length of a specimen at the start of a test shall be 20 in. between the grips of the machine.

The capacity of the machine shall be such that the specified figure for the breaking strength of the yarn under test is not less than 10 per cent. of the capacity of the machine.

All specimens for testing shall be conditioned in the standard atmosphere as described in Method No. 3(b), and the tests carried out under the same condition.

The yarn to be tested shall be taken from the fabric or package (cheese, hank, etc.) in such a manner that the twist in the yarn is not disturbed.

**Sampling and Number of Tests**

A unit sample shall consist of 5 packages (cheeses or hanks, etc.) and the number of tests from a unit sample shall be:—

50 for single yarns, 10 from each package.

20 for ply yarns, 4 from each package.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

**Criteria**

The specification shall prescribe whether the material shall conform to a mean, maximum, minimum or a range of strength.

**9 (b). TENSILE STRENGTH—FABRICS****Units**

Breaking strength shall be specified in pounds and decimals of a pound.

**Testing**

The following conditions shall be observed:—

The testing machine shall be:—

*either*: Constant rate of loading type, the rate of loading being such that the time taken to reach the specified breaking load shall be 1 minute.

*or*: Constant rate of traverse type, power driven, and with a uniform traverse speed of  $4\frac{1}{2}$  in. per minute.

The specification shall prescribe the type of machine to be used.

The free length of a specimen at the start of a test shall be 7 in. between the grips of the machine.

The capacity of the machine shall be such that the specified figure for the breaking strength of the material under test is not less than 10 per cent. of the capacity of the machine.

The specification shall prescribe whether the material is to be tested whole or whether specimens for testing are to be prepared from part widths. Narrow fabrics will normally be tested whole. When part widths are to be tested the specimens shall be frayed down to a width of 2 in. and the specification shall prescribe the width of fringe required to give satisfactory control of the edge threads in the tests.

All specimens for testing shall be conditioned in the standard atmosphere as described in Method No. 3(a), and the tests carried out under the same condition.

**Sampling and Number of Tests**

In the absence of other determining considerations a unit sample shall consist of specimens of fabric from 5 rolls, and the number of tests shall be 2 from each roll, giving a total of 10 tests. The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

**Criteria**

The specification shall prescribe whether the material shall conform to a mean, maximum, minimum or a range of strength.

**10. EXTENSION****Units**

Extension shall be expressed as a percentage of the length of the material before stretching.

**Testing Procedure**

Extension shall be measured after stretching the material in a tensile testing machine of the type specified for strength testing of yarns or fabrics.

The material specification shall state the initial and final loads between which the extension is to be measured. Whenever possible it is recommended that these shall be based upon the specified breaking load, or the specified weight per unit length of the material.

**Sampling**

The number of fabric specimens to be tested and the manner of their selection from the consignment shall be prescribed by the specification.

**11. SHRINKAGE****General**

Where satisfactory shrinkage performance is an important requirement of the material; the specification shall prescribe a suitable treatment and testing procedure, also sampling instructions and testing criteria.

**Units**

Shrinkage shall be expressed as a percentage of the length of the material before treatment.

**Measurement of Shrinkage**

The marking and measurement of the samples before and after the prescribed treatment for a shrinkage test, shall be as described in Method No. 3(a), the samples first having been conditioned in the standard atmosphere for 24 hours unless otherwise specified.

**12. FABRIC ANALYSIS—THREAD COUNTING****(a) Warp Ends**

The total number of ends in the width of the fabric shall be counted.

**(b) Picks, Plaits and Rows of Stitches**

Counting shall be on relaxed and conditioned short lengths of fabric prepared as described in Method No. 3(a). The countings must extend over at least a full inch, and to the nearest half thread, plait or row of stitches.

**Sampling and Number of Tests**

For warp ends, a unit sample shall consist of 5 rolls of fabric, and each shall be counted.

For picks, etc., a unit sample shall consist of specimens of fabric from each of 5 rolls, and two countings shall be made for each roll.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

**13. FABRIC ANALYSIS—YARN COUNT****General**

Because of the difficulty of dissecting many narrow fabrics it is recommended that the count of weft be determined by calculation from other tested cloth particulars as follows:—

The weight of warp in the fabric specimen is calculated from test results of total ends, warp crimp, warp count and specimen length. The weight of weft

is then obtained by difference from the weight of the fabric specimen. The length of weft is calculated from the tested picks per inch and the yarn length per pick. Then the weft count is computed from these calculated values of weight and length of weft.

#### **Preparation of Specimens**

Specimens of fabric  $2\frac{1}{4}$  yards long shall be conditioned as described in Method No. 3(a), and the subsequent dissection, measuring and weighing shall be carried out in the standard atmosphere.

##### **(a) Weight per unit length**

The weight per unit length of the fabric specimens shall be determined as in Method No. 6(b).

##### **(b) Number of threads**

The number of warp threads and picks shall be counted as in Method No. 12.

##### **(c) Measurement of pick length**

From each end of each  $2\frac{1}{4}$  yd. specimen ten picks of weft shall be dissected in a continuous length and measured under just sufficient tension to remove the crimp. The mean pick length for all specimens in the sample shall be calculated.

##### **(d) Measurement of warp crimp**

In each specimen two cuts shall be made a measured distance apart along the length of the fabric and two warp threads shall be dissected from this length and measured under just sufficient tension to remove the crimp. The warp crimp is the difference between the length of the warp threads and the distance between the cuts, expressed as a percentage of the distance between the cuts.

##### **(e) Warp count**

From the remainder of the  $2\frac{1}{4}$  yd. specimens, lengths of two yards are cut off and 10 complete warp ends are dissected from the full length of each 2 yd. specimen. These ends from all the specimens are then weighed together to an accuracy of 0.5 per cent., and the count is calculated after allowing for the mean warp crimp and any finishing treatment.

When the fabric is made from more than one beam or type of yarn the warp tests and calculations shall be repeated for each beam or type of yarn.

##### **(f) Weft count**

The weight of weft per gross yards of fabric is obtained by subtracting the weight of warp per gross yards [calculated by the test results of (b), (d) and (e)] from the fabric weight (a).

The length of weft per gross yards of fabric is calculated from the test results of (b) and (c).

The weft count is calculated from the length and corresponding weight so obtained.

#### **Sampling and Number of Tests**

A unit sample shall consist of 5 lengths of fabric, one from each of 5 rolls.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

## **14. TWIST IN YARNS**

### **Units**

The amount of twist shall be expressed as the number of turns per inch.

### **Testing Procedure**

The yarn to be tested shall be taken from the fabric or package (cheese or hank, etc.) in such a manner that the twist in the yarn is not disturbed.

The yarn shall be inserted in the testing apparatus with an amount of tension only just sufficient to pull it taut between the grips.

The yarn shall then be carefully untwisted and the point of zero twist deter-

mined by inserting a needle in the fibres and passing it from the fixed to the moving grip.

The following table gives recommended lengths of yarn for testing, and also the number of tests to be made from a unit sample:—

Single yarns. Cotton, Woollen, Staple fibre	} 1 in. or $\frac{1}{2}$ in.	50 tests.
Worsted, Mohair, Spun Silk, Hemp, Linen, Jute and similar material		
Continuous filament yarns	} 5 in.	20 tests.
Ply yarns. All types ... ..	10 in.	20 tests.

#### Sampling and Number of Tests

A unit sample shall consist of specimens from 5 packages of yarn, or from cuttings of fabric taken from 5 rolls. The number of tests on a unit sample shall be as indicated above.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

### 15. DIRECTION OF TWIST

"The direction of twist shall be as defined in British Standard Specification No. 946, viz.:—

#### Single Yarns

"A yarn has "S" twist if, when it is held in the vertical position, the spirals conform in direction of slope to the central portion of the letter "S". Similarly the yarn has "Z" twist if the spirals conform in direction of slope to the central portion of the letter "Z".

#### Folded Yarns and Cables

"The direction of the twist in successive twisting operations is described by a series of letters "S" and "Z" in which the first letter or group of letters gives the direction of the twist in the single yarns. The letter (or letters) referring to the single yarns, may, if desired, appear in smaller type.

"Twist in folded yarns is designated "S/S" or "Z/Z" when the folding turns are in the same direction as those in the single yarns.

"When folding twist is in the opposite direction to that in the single yarns, the designation is "S/Z" or "Z/S", and in successive cabling operations, yarns may be shown as "S/Z/S. . ." or "Z/S/Z. . ."

When single yarns of opposite twist are folded, the designations are "SZ/S" or "SZ/Z" according as the doubling twist is in the "S" or the "Z" direction."

### 16. CURL

#### General

The material specification shall prescribe whether the specimens shall be specially conditioned as described below, or otherwise pre-treated before their curls are assessed. If the conditions of use are such that unconstrained short lengths may develop or increase their curls by increase or fluctuation of moisture content, it is recommended that the specimens shall be exposed to water vapour or liquid water in such a manner as to effect such increase in the curl. For general purposes and in the absence of special considerations which indicate other procedure, it is recommended that the development method given should be adopted.

#### Preparation of Specimens

Fabrics wider than 2 in.:—Discs of 2 in. diameter shall be cut from the samples.

Fabrics narrower than 2 in.: Specimens 2 in. long shall be cut from the samples.

### Pre-Treatment of Specimens

The specimens shall be conditioned over a saturated solution of sodium sulphate in a closed chamber.\* If the air is not removed from the chamber the specimens shall be conditioned for 24 hours. If the air is very largely removed as by the use of a "desiccator" evacuated by water pump, the specimens shall be conditioned for one hour.

\*This solution gives approximately 82 per cent. R.H. at room temperature.

### Testing Procedure

The specimens shall finally be conditioned in the standard atmosphere for 24 hours, before proceeding to assess their curls.

In order to ensure the removal of transient curl they shall first be made to lie flat on a table; no more than the minimum pressure necessary for this purpose shall be employed and the specimens shall be held flat for 2 to 3 seconds.

The specimens shall then be allowed to curl freely for one minute.

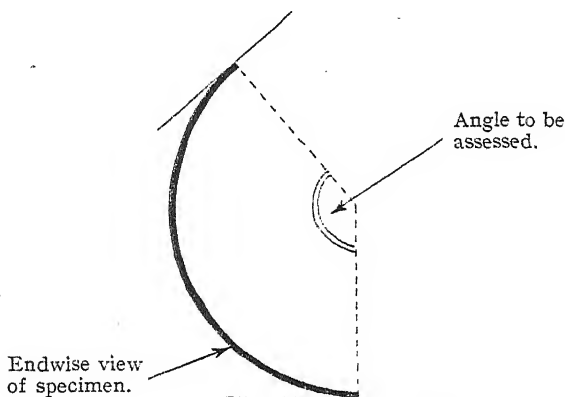


Fig. 1.

The angular rotation of one extremity of the specimen with respect to the other is then assessed by viewing the curled specimen so that it presents the appearance of a cylindrical tube or part of such a tube. This will in general mean that the specimen is viewed along a line at some angle to the warp threads or weft. The assessment is made to the nearest 10 degrees. It has been found that when the curl is less than one whole turn the angle is more readily estimated when the specimen is held at arm's length so that the direction of one extremity is horizontal.

### Direction of Curl

If the direction of curl is important it is determined as follows:—

A line is drawn on the concave side of the specimen parallel to the axis of its cylindrical form. The angle between this line and the weft direction is measured, reckoning clockwise from the line.

If it is necessary, and possible, the face and back of the cloth shall be identified and the convexity or concavity of the face noted.

### Criteria and Performance

The material specification shall prescribe the desired performance in respect of curl and may include a demand that the direction of any particular curl shall be assessed.

### Sampling

The specification shall prescribe the number of tests to be carried out and the manner of their selection from the consignment.

## 17. BOW

### Preparation of Specimens

Samples of fabric exhibiting this characteristic shall be conditioned and prepared as described in Method No. 3(a). The fabric shall then be laid on a smooth surface without any constraint other than the application of such minimum pressure as is necessary to make it lie flat.

### Testing Procedure

A steel rule shall be placed on the fabric in such a manner that a chord of appropriate length spans the inside of a bowed portion of the fabric.\* The maximum perpendicular distance— $d$  inches—to this chord, from the edge of the fabric shall be measured with a second steel rule. The width of the fabric— $w$  inches—shall also be measured with a steel rule.

\*In view of the variability of this characteristic it is recommended that the length of the chord shall be relatively short. Therefore the chord length shall be 10 inches whenever possible, but in cases where the value of  $d$  is too small to be measured with reasonable accuracy, alternative chord lengths of 20 in., 30 in., or 40 in. shall be used.

### Expression of Results

The bow shall be expressed as the Percentage Length Differential, which is calculated from the formulæ:—

$$\begin{aligned} \text{Percentage Length Differential} = & \frac{8}{d} \frac{w}{w} \text{ for chord length of 10 in.} \\ & \frac{2}{d} \frac{w}{w} \text{ „ „ „ „ 20 in.} \\ & \frac{8}{9} \frac{d}{w} \text{ „ „ „ „ 30 in.} \\ & \frac{1}{2} \frac{d}{w} \text{ „ „ „ „ 40 in.} \end{aligned}$$

### Criteria and Performance

The material specification shall prescribe the performance of the material in this test, stating whether the specified value for bow relates to a maximum or a mean.

### Sampling

The specification shall prescribe whether inspection for bow is to be on the whole or a portion of the consignment and also the number of specimens to be tested.

## 18. WATER REPELLENCY—FABRICS

### General

This is a simple spray test in which the apparatus and practical operations are clearly defined so that reproducible results are assured. The results of testing are assessed after visual examination and comparison with an arbitrary scale of values ranging from maximum to minimum repellency.

### Apparatus

The spray device consists of a glass funnel fixed vertically, with a metal nozzle attached to the end of the stem by a short length of rubber tubing. The stem of the funnel is shortened to about  $\frac{3}{4}$  in. so that the face of the nozzle is 3 inches below the neck of the funnel.

The face of the nozzle is  $1\frac{1}{2}$  in. in diameter, slightly convex, and with 19 holes drilled with a No. 65 drill (0.035 in.). The perforations are equally distributed over the face of the nozzle, the arrangement comprising a central hole surrounded by two concentric rings of holes. The inner circle is of  $\frac{1}{2}$  in. diameter and contains 6 holes. The outer circle is of 1 in. diameter and contains 12 holes. The duration of flow for the test quantity of 250 ml. of water poured into the funnel should be 25-30 seconds and the spray should cover an area of 6 in. diameter at a distance of 6 in. from the nozzle.

The fabric test specimens are supported by clamping in a thin double frame of wood or metal—6 in. square inside dimensions. The fabric frame, when in position for a test, rests loosely on a suitable support so that it is at an angle

of 45 degrees to the stem of the funnel and with the centre of the test area 6 in. vertically below the centre of the spray nozzle.

### Testing Procedure

The specimens of fabric for this test (8 in. long) shall be conditioned in the standard atmosphere for 24 hours and the tests carried out immediately afterwards.

The minimum test width of fabric shall be 4 in.

For fabrics narrower than this two or more specimens shall be tested at one time, side by side, to give an effective width of 4 in. or over.

For fabrics wider than 6 in. strips at least 4 in. wide shall be prepared.

To carry out a test the conditioned fabric is mounted in the frame and placed in position below the spray nozzle. Unless contrary instructions are given, the fabric shall normally be placed so that the warp direction is parallel to the flow of water running off the fabric. 250 ml. of water at 70° F. shall then be poured into the funnel, this being done quickly, but steadily, in order that the spraying shall be continuous once it has commenced. Immediately the spray has ceased the fabric frame is removed and tapped smartly six times against a solid object (three taps each on opposite edges of the frame) to remove loosely adhering water from the face of the fabric. During this operation the fabric is held in an almost vertical position but with the test face leaning slightly forward.

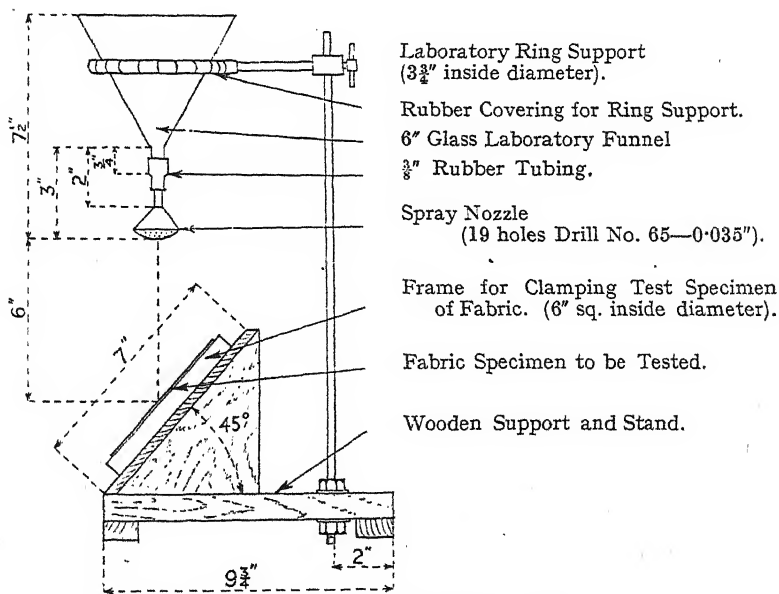


Fig. 2. Apparatus for Water Repellency Test.

### Assessment of Results

The performance of the fabric in this test is judged by carefully examining the surface of the test specimen immediately after the test, while still in the clamping frame. The surface of the fabric is viewed by reflected light from both upward and downward directions. The extent of the actual wetting of the surface is noted and also the extent of penetration of the wetting below the surface of the fabric. A comparison is then made with a series of standard spray test ratings and the performance judged thereby. A suitable scale for such a series of standards would be in accordance with the following descriptions:—

- 100 Surface of fabric remains absolutely dry.
- 90 Slight random clinging of small droplets to surface.
- 80 Slight wetting of surface of fabric at points of impingement of the individual spray jets, not exceeding one-third of total surface area.
- 70 Considerable wetting of surface of fabric, exceeding one-third, but not covering the whole of the test area.
- 50 The entire surface of the fabric is wetted, but there is little or no penetration to the back.
- 0 Complete wetting and penetration throughout the test area.

Observation of the effect on the fabric during spraying, and also of the appearance of the globules of water remaining on the surface before subsequent tapping, will provide useful evidence in cases where there is some difficulty in classifying the result between two adjacent ratings in the scale.

Each determination shall be the average of 5 test results.

#### Criteria

The material specification shall prescribe the appropriate repellency standard for judging this test. In the absence of other determining factors it is recommended that this shall not be below the category of 90 in the above scale.

It is also recommended that wherever possible unproofed samples of the same fabric shall also be subjected to the test, and that the specification shall prescribe the minimum difference of repellency values between the proofed and unproofed fabric.

### 19. WATER REPELLENCY—YARNS

A small faggot weighing about 10 g. secured with thread at each end, shall be made up from the hanks and placed on the surface of distilled water contained in an open vessel. The water will previously have been heated to a temperature of 140° F. and this temperature shall be maintained throughout the test.

The yarn will be considered satisfactory if the faggot remains floating on the surface of the water for a period of 2 hours.

In case of doubt or dispute the yarn shall be conditioned before testing, as described in Method No. 3(b).

## Part II

### THE SPECIAL CHARACTERISTICS OF ELASTIC NARROW FABRICS

#### FOREWORD

In general, tests for the dimensional and physical properties of narrow fabrics, in Part I, shall also be applied as required, but the preparation of the samples for testing shall be as described in Method No. 20, with the single exception of the test for delivery condition which remains as in Method No. 2.

### 20. CONDITIONING AND PREPARATION OF SAMPLES FOR TESTING (Other than Delivery Condition)

#### General

Fabrics containing rubber threads continue to retract in length for a considerable time after manufacture, and it is therefore essential to ensure that samples for testing purposes shall be so treated as to bring about satisfactory relaxation before measurement.

#### Standard Atmosphere

This is defined in the first paragraph of Part I.

#### (a) Fabrics. (All tests except Determination of Weight per Unit Length)

Specimens of fabric as required for the various tests shall be prepared from samples which have been allowed to relax for not less than 4 days after taking



from the loom, or from the last finishing process or other source of substantial tension.

The samples shall then be warmed at a temperature of 90° F. for one hour, and shall then be "massaged" by stretching them twelve times to the point of greater resistance.

This treatment shall be followed by conditioning of the freely relaxed samples in the standard atmosphere for one hour.

If the specimens are required to be of definite length they shall then be marked to the requisite degree of accuracy with the aid of a steel rule, and for stretch measurements, a gauge distance shall be suitably marked.

**(b) Fabrics (Determination of Weight per Unit Length).**

The specimens of fabric shall be prepared as described above, but the time of final conditioning in the standard atmosphere shall be 24 hours.

**(c) Rubber Thread**

For tests involving measurement of the length of extracted rubber threads, e.g. determination of the unstretched length of the rubber threads in relation to the length in the fabric, or determination of count, the threads shall be withdrawn from 5 in. lengths of fabric prepared from samples which have been treated as described above in Method No. 20(a).

The extracted rubber threads shall be warmed at a temperature of 90° F. for a further period of one hour, and then again conditioned in the standard atmosphere for one hour.

## **21. RUBBER THREAD CONTENT OF ELASTIC FABRICS**

### **Designation**

The rubber thread content of elastic fabrics shall be specified as the total weight of rubber thread in a certain length of the finished fabric which has been relaxed and conditioned as described in Method No. 20(a).

### **Units**

The rubber thread content shall be expressed in pounds and decimals of a pound per gross yards of fabrics.

### **Testing Procedure**

Fabric specimens 5 in. long shall be prepared from samples which have been treated as described in Method No. 20(a).

From each specimen the same number of rubber threads shall be taken and the textile covering removed.

The rubber threads shall then be weighed to within an accuracy of 1 per cent., and from this weight and the knowledge of the total number of rubber threads in the whole width of the fabric the estimated mean weight of rubber per 144 yards shall be calculated.

### **Sampling and Number of Tests**

In the absence of other determining considerations, it is recommended that a unit sample shall consist of one specimen from each of 3 rolls of fabric, and that a total of 36 threads shall be extracted, 12 threads from each roll.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

### **Performance**

The material specification shall prescribe the permissible limits of rubber thread content of the fabric by this test.

## **22. STRETCH CHARACTERISTICS OF ELASTIC FABRICS**

### **General Remarks**

The performance of elastic fabrics can be considered under a number of headings, of which the following are the most important from the practical point of view of testing, and the satisfactory service of the material.

*The performance when the material is immediately stretched for periods not exceeding about 2 minutes.* The material should show an adequate limit of useful extension, and should develop an appropriate tension at this limit and at intermediate stretches both in extension and retraction.

*The behaviour when the material is stretched within the limit of useful extension for periods of the order of 18 hours.* Here it is a question of the imperfection of the elasticity or flow; a feature more to be expected in material containing synthetic rubber. The material should show a minimum decay of tension when stretched for such a period.

*The performance after periods of frequent stretching and relaxing within the limit of useful extension.* In such conditions resistance to fatigue is important; otherwise there may be serious loss of stretch characteristics, or even breakdown of the fabric due to actual failure of some or all of the rubber threads. Fabrics containing synthetic rubber are again more likely to be affected, and after such treatment it is essential that the elastic properties should be retained to a useful degree.

*The performance after much longer periods of time, of the order of 6 months and upwards.* Here it is a question of loss of the desired properties because of chemical changes in the rubber or other elastic constituent of the fabric. The material should show a minimum loss of elasticity when it is stored under certain defined atmospheric conditions.

The following tests in this section are based upon this classification.

## 23. IMMEDIATE ELASTIC PROPERTIES

### General

The following quantities are measured in this test: The stretch ratios  $S_1$ ,  $S_2$ ,  $S_3$ , etc., developed in the material when it is subjected to loads  $W_1$ ,  $W_2$ ,  $W_3$ , etc.

The material specification shall prescribe the loads to be applied, but the following recommendations are made:—

(1) The specification shall state the load required to stretch the material to its limit of useful extension or near thereto.

(2) In addition the specification shall prescribe, when considered necessary, certain loads intended to produce intermediate stretch ratios related to the use of the material, by either load-extension or unload-retraction, or both.

(3) The stretch ratio at zero load on completion of a test shall be measured.

### Designations

The *stretch ratio* is the ratio of the stretched length of the material to its original unstretched length.

The *Limit of Useful Extension*<sup>2</sup> is the same as the loom stretch or the stretch produced by the tension under which the fabric was woven, and it is the point at which considerably greater resistance is felt when the fabric is stretched between the hands. The method of determining its value is explained in the appendix to this test.

### Units

Loads shall be measured in pounds weight and decimals of a pound weight.

The stretch ratio shall be expressed decimally.

### Testing Procedure

Specimens of fabric for this test shall be prepared as described in Method No. 20(a). For measurements of stretch during the test a distance of 5 inches shall be suitably marked in the middle of each specimen, and the length of the specimens shall be such that when mounted in the testing apparatus there shall be a distance of 3 inches between each end of the marked length and the fixing points.

Loading and unloading shall be performed steadily, each weight being applied or removed gradually.

The load changes shall be effected successively at two minute intervals and the stretch measurements taken at the end of each interval.

Fabrics up to 2 in. wide shall be tested whole-width.

For fabrics wider than this the specimens shall be frayed down to a specified number of rubber ends occupying approximately 2 in.

#### Sampling and Number of Tests

In the absence of other determining considerations it is recommended that a unit sample shall consist of 3 rolls of fabric and that one specimen from each roll shall be tested.

The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

#### Criteria

The material specification shall prescribe whether mean values shall be computed or whether all the results shall comply with the performance demanded for the material or whether any other system of compliance of the results with the demands shall be followed.

#### Performance

The material specification shall prescribe the permissible limits of the stretch ratios which are to be measured by this test.

### APPENDIX

#### Determination of the Limit of Useful Extension

(1) Plot the characteristic curves of the fabric for load-extension and unload-retraction, on any convenient scale.

(2) Draw the tangent to the unload curve from the origin.

(3) Drop a perpendicular from any convenient point  $P_1$  on this tangent, to the load axis at A, and mark off on it a height AB equal to  $1/5$ th of the height  $AP_1$ .

(4) Draw a straight line through OB, and then draw a second tangent to the unload curve parallel to OB.

(5) Read off the extension at the point of contact  $P_2$  of the second tangent. This is the limit of useful extension. The load required to produce it is read from the load curve.

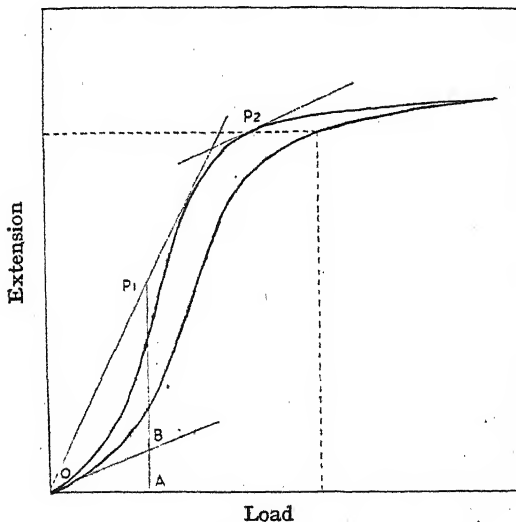


Fig. 3.

## 24. DECAY OF TENSION AT CONSTANT STRETCH-RATIO

### General

The decay of tension in this test is the fall of tension after a certain lapse of time during which a specimen of fabric has been maintained at a constant stretch-ratio. It is measured by the tension-ratio.

The material specification shall prescribe the stretch to be applied.

In the absence of other determining considerations it is recommended that the stretch-ratio for this test shall be the value given by the point of contact of the tangent from the origin to the unload curve.

### Designation

The tension-ratio is the ratio of the tension in the specimen at the end of the test, to the tension in the specimen at the start of the test.

### Units

The tension-ratio shall be expressed decimally.

### Preparation of Test Specimens

All samples of fabric for this test shall be treated as described in Method No. 20(a).

The material may be tested in the form of either bands or single strips. (see Note 1.)

Band specimens are formed from strips of fabric of suitable length by securing their ends together.

An appropriate gauge distance for stretch measurements shall be marked on all test specimens.

In the absence of contrary instructions it is recommended that band specimens shall be prepared from  $12\frac{1}{2}$  in. strips of fabric, by stitching the ends of each specimen together with a flat overlap of  $\frac{1}{2}$  in., using three rows of hand-sewn stitches. The loop so formed shall be laid flat with the overlap at one end, and marked with a gauge distance of 5 inches.

Specimens for testing in single strip form shall be 7 in. long unless otherwise prescribed and the gauge distance of 5 inches shall be marked centrally on each specimen.

Fabrics up to 2 in. wide shall be tested whole width.

For fabrics wider than 2 in., and in the absence of other deciding factors, it is recommended that the specimens shall be frayed down to a specified number of rubber ends occupying approximately 2 in.

### Apparatus

The apparatus shall comprise suitable means for maintaining the test specimens at any specified stretch-ratio, and for measuring the tension in the stretched specimens. The diagram illustrates a typical form of apparatus which has given satisfactory results in practical tests.

Band specimens are stretched by two brass bars of not greater than  $\frac{1}{4}$  in. diameter. The upper bar,  $b_1$ , is rigidly held by a brass boss,  $B_1$ , on a  $\frac{1}{2}$  in. mild steel rod  $R$ . The lower bar,  $b_2$ , is held by a brass shackle,  $S$ , having a lower aperture through which passes another brass bar of  $\frac{1}{4}$  in. diameter,  $b_3$ , held by an adjustable boss,  $B_2$ , on the rod  $R$ . The sides of the aperture have insulating cheeks of suitable material. The boss  $B_2$  is provided with a terminal,  $T$ , so that connection can be made to a 2-volt accumulator. Another wire has one end held in contact with the shackle by being bound under one of the knurled nuts which secure the bar  $b_4$  in the shackle. This wire is connected to the accumulator via a 2.5V flash lamp bulb and switch. With this arrangement it is possible to see whether the bar  $b_3$  is in contact with the bar  $b_4$ . It is necessary to keep the brass surfaces clean, otherwise the visual warning device may fail to operate. A hook,  $H$ , below the bottom plate of the shackle allows tension to be applied to the specimen by a hanger and deadweights and by a 1 kg. spring balance reading to 0.01 kg. When the tension so applied is just in excess of the tension in the specimen, the latter extends slightly and so breaks the contact between the bars. When stretched specimens are to be stored over-

night for the duration of the test, they can be removed by detaching the rod R assembly after removal of the hanger weights and spring balance. Further specimens can then be tested simultaneously by the use of additional rods and fittings. Strip specimens are tested by the use of suitable non-slip grips which slide on the bars  $b_1$  and  $b_2$ .

### Testing Procedure

When inserting test specimens in the apparatus single strips are fixed so that the gauge marks are clear of the grips; and band specimens are set so that the stitched overlap lies over one of the end supports. The tests shall be carried out under standard atmospheric conditions as described in Part I. Each specimen is brought to the required stretch-ratio, using the gauge marks for measurement, and the apparatus is then clamped in that position. The initial tension in the specimen is measured at the end of 2 minutes after applying the stretch. The specimen is then maintained in the stretched state for a period of 18 hours (see Note 2), after which the tension is again measured. The gauge distance is measured on the relaxed sample after a specified lapse of time, for comparison with the original length before the test.

NOTE 1.—It has been shown that there is no practical difference for the purposes of this test, in the results given by the two types of specimen.

NOTE 2.—Tension decay continues for a considerable time, if not indefinitely. In the absence of other decisive considerations it is recommended that 18 hours shall be specified for the duration of this test. This gives characteristic results and is also closely related to the conditions of use of many elastic materials.

### Sampling and Number of Tests

In the absence of other determining considerations it is recommended that a unit sample shall consist of three rolls and that one specimen from each roll shall be tested. The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

### Criteria

The material specification shall prescribe whether mean values shall be computed or whether all the results shall comply with the performance demanded for the material, or whether any other system of compliance of the results with the demands shall be followed.

### Performance

The material specification shall prescribe the permissible limits of the tension ratio of the material.

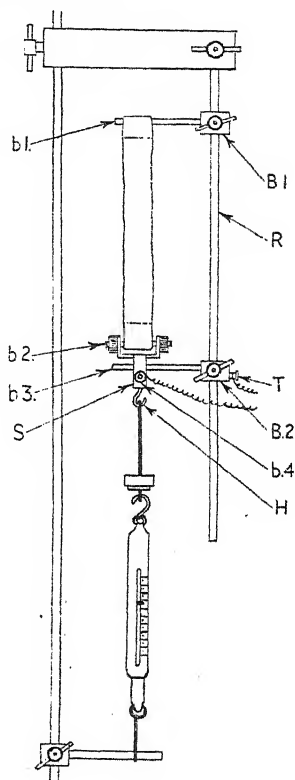


Fig. 4.

## 25. FATIGUE OF ELASTIC FABRICS

### General

Specimens of fabric are subjected to repeated stretching, after which the effects on the properties of the material are examined.

### Testing Procedure

Specimens of fabric for this test shall be prepared as described in Method No. 20(a).

The specimens shall first be mounted so that they are at zero tension, but not slack, and shall then be repeatedly stretched by suitable mechanical means

to the limit of useful extension, at a rate of 60 to 100 oscillations per minute, for a specified number of oscillations.

The specimens shall then be subjected to one or more of the following tests:

(1) Measurement of the length (over a previously marked portion), at zero tension, for comparison with the length before the fatigue treatment.

(2) Test for immediate elastic properties.

(3) Test for decay of tension.

The material specification shall prescribe the number of oscillations to be applied in this test, and shall prescribe the appropriate tests to be applied after the treatment.

#### **Sampling and Number of Tests**

In the absence of other determining considerations it is recommended that a unit sample shall consist of 3 rolls, and that a sufficient number of specimens shall be subjected to the fatigue treatment to enable each of the subsequent tests to be applied to one specimen from each of the 3 rolls. The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

#### **Criteria**

The material specification shall prescribe whether mean values are to be computed or whether all the results shall comply with the performance demanded for the material, or whether any other system of compliance of the results with the demands shall be followed.

#### **Performance**

The material specification shall prescribe the performance of the fabric in this test.

### **26. AGEING TEST**

#### **General**

Specimens of fabric are aged by a prescribed heating treatment in air, and are afterwards submitted to various tests to determine any deterioration in their properties.

#### **Ageing Treatment**

The fabric specimens for this test shall be prepared as described in Method No. 20(a).

The specimens shall then be heated in an electrically heated dark oven at a temperature of  $70^{\circ}\text{C.} \pm 1^{\circ}$  for 240 hours.

The total volume of the specimens shall not exceed 5 per cent. of the air space of the oven. The air shall circulate freely on both sides of the specimens; this may be achieved by a forced circulation of the air around suspended specimens, or by mounting the specimens on a cage which can be revolved in the oven. The oven shall be ventilated by devices dependent upon natural convection or by the deliberate introduction of a slow stream of fresh air equivalent to a complete change of air about three times per hour.

After removal from the oven the specimens shall be allowed to relax freely and condition for 24 hours in the standard atmosphere.

#### **Testing of Aged Specimens**

The material specification shall prescribe the tests to be carried out after the above treatment. One or more of the following tests may be prescribed:—

(1) Test for Immediate Elastic Properties. (2) Test for Tension Decay. (3) Fatigue Test. In addition, or alternatively, the following tensile test may be prescribed:—

The specimens shall be stretched in a tensile testing machine to the point of rupture of the textile warp threads. Such rupture shall take place in about one minute. The breaking load shall be observed and any breakage of the elastic threads at this point shall also be noted.

**Sampling and Number of Tests**

In the absence of other determining considerations it is recommended that a unit sample shall consist of 3 rolls and that sufficient specimens shall be aged to enable each of the subsequent tests to be applied to one specimen from each of the 3 rolls. The number of unit samples and the manner of their selection from the consignment shall be prescribed by the specification.

**Criteria**

The material specification shall prescribe whether mean values shall be computed or whether all the results shall comply with the performance demanded for the material, or whether any other system of compliance of the results with the demands shall be followed.

**Performance**

*Test of Immediate Elastic Properties and Test for Tension Decay at Constant Stretch-Ratio.* The performance shall be demanded in the form already described for those tests; the numerical values of the permissible limits will, however, require to be appropriately adjusted for the aged material.

*Tensile Test.* The material specification shall prescribe the permissible breaking load for the textile threads, and may demand that none of the elastic threads shall have broken under this load.

**27. APPLICATION OF ADDITIONAL TESTS TO ELASTIC FABRICS**

Any or all of the Chemical Tests and Colour Fastness Tests in Parts Three and Four of these proposals may be required by the material specification for an elastic fabric.

After such tests have been carried out, one or more of the following tests may be prescribed:—

- Test for Immediate Elastic Properties.
- Test for Tension Decay.
- Fatigue Test.
- Tensile Strength Test.

**Part III****CHEMICAL TESTS****28. pH VALUE OF AQUEOUS EXTRACT, ACIDITY AND ALKALINITY****Preparation of Extract**

10 g. of the sample, cut into pieces  $\frac{1}{2}$  in. square or less if practicable, shall be boiled in 200 ml. of distilled water for  $\frac{1}{2}$  hour. After decanting the extract, the fabric residue shall be twice re-extracted, each time with 100 ml. of distilled water for 15 minutes at the boil. The combined extracts shall be filtered, if necessary, and after cooling, made up to 400 ml. with boiled out distilled water.

**Testing for pH Value**

The pH value of the aqueous extract shall be determined by a standard method, either electrometrically, or by the use of appropriate indicators.

The material specification shall prescribe the appropriate pH range. Alternatively, in certain cases, the specification may prescribe a maximum permissible amount of acidity, calculated as sulphuric acid, or of alkalinity, calculated as sodium carbonate, determined by titration to a stated pH value. In such cases, titration may be either electrometric, to the stated pH value, or by the use of suitable or specified indicators.

**Blank Test on the Water**

This must be carried out under identical conditions and the necessary corrections applied.

## 29. TOTAL WATER-SOLUBLE MATTER

An aliquot portion of filtered extract prepared as described in Method No. 28, shall be evaporated to dryness on a steam bath. The residue shall then be dried to constant weight in an oven at a temperature of  $105^{\circ}$ - $110^{\circ}$  C., and its percentage weight in relation to the conditioned weight of the fabric calculated.

## 30. WATER-SOLUBLE CHLORIDES

### Method No. 1

10 ml. of extract prepared as described in Method No. 28, shall be transferred to a suitable vessel and a few drops of 2N-nitric acid are added.

A similar vessel containing a saturated solution of silver chloride in water to which a few drops of 2N-nitric acid and a few ml. of N-ammonium nitrate have been added, is connected to the first vessel by means of a suitable bridge. (See appendix.)

A stout silver wire electrode is placed in each vessel, and the cell so formed is connected in series with a tapping key and a galvanometer. N-100 silver nitrate is run into the extract solution, closing the circuit momentarily by means of the key, after each addition. The end point is indicated by a reversal of the galvanometer deflection.

### Appendix

A suitable bridge for use in the above test consists of a U tube of  $\frac{1}{4}$  in. glass tubing with legs about 2 ins. long. A solution of 3 per cent. agar in N-ammonium nitrate is allowed to set in the bend of the tube. Then the legs of the tube are filled with a solution of N-ammonium nitrate. The ends of the tube are plugged with rolls of filter paper.

Alternatively the following method may be employed:—

### Method No. 2

10 ml. of extract prepared as described in Method No. 28 shall be transferred to a 150 ml. beaker, diluted to 60 ml. with distilled water, and 1 ml. of 5 per cent. nitric acid added. Stir thoroughly and filter through a Whatman No. 42 paper into a 100 ml. Nessler tube, washing twice with distilled water. Make up to 100 ml. with distilled water and add 1 ml. of 0.1 per cent. aqueous solution of silver nitrate. Stir thoroughly and compare the turbidity with a series of standards prepared at the same time under similar conditions.

## 31. WATER-SOLUBLE SULPHATES

400 ml. of extract shall be prepared from 10 g. of the material as described in Method No. 28. The solution is filtered, and 3 ml. of concentrated hydrochloric acid are added. The solution is then brought to the boil and 10 ml. of a boiling 2 per cent. solution of barium chloride is added, drop by drop. The boiling shall be continued until the precipitate coagulates. Allow the mixture to cool overnight and weigh the barium sulphate in the usual manner.

## 32. WATER-SOLUBLE PHOSPHATES

### General

This is estimated as ammonium di-hydrogen phosphate volumetrically by titration with uranium acetate solution.

### Method

200 ml. of extract prepared as described in Method No. 28 shall be titrated with standard uranium acetate solution which is made up by dissolving 15 g. of uranium acetate in 500 ml. of water to which are added 17 ml. of glacial acetic acid.

1 ml. of uranium acetate solution  $\equiv 0.007$  g.  $(\text{NH}_4)_2\text{H}_2\text{PO}_4$

This is standardised against di-ammonium phosphate (A.R. quality) as follows:—



The uranium acetate solution is titrated into the extract solution until the end point is almost reached (pre-determined by a rough titration), then the solution is just raised to the boil and the titration completed. A 5 per cent. potassium ferro-cyanide solution is used as external indicator, the first brownish colouration being the end point.

### 33. EXTRACTION WITH OTHER SOLVENTS

#### General

The determination of matter extractable by the various organic solvents shall be carried out by the following standard method:—

#### Method

5 g. of the material shall be extracted for four hours in a Soxhlet extractor. The solution is then filtered, if necessary, and evaporated, and the residue dried to constant weight at a temperature of 105–110° C.

The method shall be applicable to any of the following solvents: ether, methylene chloride, alcohol, benzene-methyl alcohol mixture.

### 34. SOLUBLE CHROMIUM

#### Foreword

In those cases where proofing of fabrics against attack by micro-organisms is carried out by impregnation with chromium and iron salt solutions, followed by development with potassium chromate, the active proofing principle on the fibre is hexavalent chromium. The latter is estimated by the method described below for soluble chromium-hexavalent.

#### Extraction Procedure

A quantity of the material is well shredded. A portion (2.5 g.) is then weighed out into a 100 ml. conical flask, 50 ml. of extracting liquor are added (pH 7.8 borax/boric acid, for wool; pH 9.2 M20-borax for cotton and flax). The conical flask is weighed and the total weight noted. The contents of the flask are then maintained at 40° C. for 30 minutes with occasional shaking, then cooled, and any loss in weight by evaporation replaced by distilled water. The textile material is then removed by filtering through a Whatman No. 44 filter paper, and the chromium content of the solution determined.

#### (a) Soluble Chromium—Hexavalent

10 ml. of the filtrate are treated with 1 ml. of diphenylcarbazide reagent (an 0.2 per cent. solution in a mixture of glacial acetic acid—1 part, and rectified spirit—9 parts) followed by 2 ml. of 2N-sulphuric acid. The solution is made up to 50 ml. in a graduated flask. A standard chromium solution containing 0.00001 g. of Cr<sup>vi</sup> per ml. (0.0283 g. of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> per litre) is prepared, and a set of colorimetric standards obtained by taking, respectively, 1, 2 and 3 ml. of this solution and treating after dilution with 1 ml. of the diphenylcarbazide reagent and 2 ml. of 2N-sulphuric acid. The volumes are then made up to 50 ml. in graduated flasks. After 15 minutes the solution prepared from the fabric and the nearest of the three standards are matched in a suitable colorimeter, using a depth of 30 mm. for the standard and varying the depth of the sample until the fields match. If the depth of the sample is less than 25 mm. or more than 35 mm. an adjustment must be made in the volume of the filtered extract taken. The volume of the extract in ml. to be taken in the final matching will be 10 × depth of sample / depth of standard. Assuming that a 2 ml. chromium standard has been employed to match the colour generated from 10 ml. of the cloth extract solution, the result in p.p.m. of Cr<sup>vi</sup> on the air-dry weight of the fabric is calculated as follows:—

$$\text{Cr}^{\text{vi}} \text{ p.p.m.} = 0.00002 \times \frac{\text{depth of standard}}{\text{depth of sample}} \times \frac{50}{10} \times \frac{10^6}{2.5}$$

**(b) Total Soluble Chromium**

A volume of the filtrate equal to that finally taken in the previous determination is treated with 0.5 ml. of water saturated with bromine and then with 2N-sodium hydroxide until the colour has discharged and two drops have been added in excess. After 1 minute, 1 ml. of an 0.7 per cent. solution of phenol, 1 ml. of the diphenylcarbazide reagent, and 2 ml. of 2N-sulphuric acid are added. The volume is then made up to 50 ml. with distilled water. After 15 minutes, the colour is matched against the standards as already described.

### 35. IRON, CHROMIUM, COPPER—PRELIMINARY SEPARATION METHODS

**General**

The methods for the analysis of fabrics containing iron, chromium and/or copper depend upon the number of metals in the material and the quantities in which they are present. The separation of the constituents to be determined usually presents more difficulty than their estimation and it has therefore been deemed advisable to give the procedure in some detail. The following methods of analysis will cover the majority of cases, but instances may arise of difficulty in the dissolution of metals after the preliminary ashing or of difficulties introduced by the presence of silica (e.g. from china clay in sizing) or of metals other than those listed. It is desirable, therefore, that all analyses should be carried out by, or under the direction of an experienced analyst.

**(a) Copper content large; iron and chromium absent**

The material (5 g.) is dried at 110° C., weighed, transferred to a 55 mm. silica or porcelain crucible and ashed in a muffle furnace at incipient red heat (450° C.). The ash is dissolved by heating with 2N-sulphuric acid, the solution transferred to a conical flask, filtering if necessary, and the copper determined by Method No. 38(a).

**(b) Copper content small; iron and chromium absent**

The sampled material (1 or 2 g.) is dried at 110° C., weighed and ashed in a silica or porcelain crucible at incipient red heat. The ash is digested with aqua regia, the solution evaporated to dryness, the residue moistened with a few drops of 0.2N-hydrochloric acid, and evaporated again. It is then dissolved in 0.2N-hydrochloric acid, filtered if necessary, and made up to 100 ml. Copper is then determined by Method No. 38(b).

**(c) Iron present; copper and chromium absent**

The sampled material (1 or 2 g.) is dried at 110° C., weighed and ashed in a silica or porcelain crucible at dull red heat. The ash is digested with 5 ml. of concentrated hydrochloric acid until the ferric oxide has dissolved completely, and the solution evaporated to dryness. The residue is dissolved in N-hydrochloric acid and transferred to a 250 ml. conical flask, filtering if necessary. If the iron content is large it is determined by Method No. 36(a). If the iron content is small, the filtrate is made up to 100 ml. in a graduated flask and the iron determined by Method No. 36(b).

**(d) Chromium present; iron and copper absent**

The sampled material (1 or 2 g.) is dried at 110° C., weighed and ashed in a silica or porcelain crucible at dull red heat. The ash is digested with concentrated nitric acid (5 ml.) and A.R. potassium chlorate (0.3 g.), the crucible being covered with a watch-glass during the process. After the chromic oxide has dissolved, the contents of the crucible are evaporated to dryness, treated with 5 ml. of 2N-sulphuric acid and evaporated to dryness again. The residue is then treated with 2N-sulphuric acid and transferred to a 250 ml. conical flask, filtering if necessary. If the chromium content is large it is determined by Method No. 37(a). If the chromium content is small, the solution is made up to 100 or 250 ml. and analysed by Method No. 37(b).

**(e) Iron and chromium present; copper absent**

The sampled material (1 or 2 g.) is dried at 110° C., weighed and ashed in a muffle furnace at dull red heat in a 55 mm. silica or porcelain crucible. Concentrated nitric acid (5 ml.) and potassium chlorate A.R. (0.3 g.) are added and the crucible is heated on a boiling water bath until a clear solution or one containing only a white residue of silica is obtained. After evaporation to dryness the residue is dissolved in dilute sulphuric acid (5 ml.) and the solution again evaporated to dryness. The residue is then dissolved in dilute sulphuric acid and transferred to a 250 ml. conical flask, filtering to remove silica if necessary. The filtrate is brought to the boil and sufficient 2N-sodium hydroxide is added to precipitate the iron as ferric hydroxide and afford an excess of approximately 10 ml. The flask is then closed with a pear bulb stopper and the solution boiled for one minute before filtering through a No. 541 Whatman filter paper. The filtrate containing the chromium as sodium chromate, is acidified with sulphuric acid and analysed by Method No. 37(a) or (b), according to the quantity present. If Method (b) is used the acidified solution is cooled and made up to 250 ml. in a graduated flask.

The ferric hydroxide precipitate is dissolved in hot N-hydrochloric acid and the solution cooled. If the amount of iron is large it is estimated by Method No. 36(a). If the iron content is small the solution is made up to 250 ml. and Method No. 36(b) employed.

**(f) Copper and chromium present; iron absent**

The sampled material (1 to 5 g. according to the anticipated copper and chromium contents) is dried at 110° C., weighed and ashed in a muffle furnace at incipient red heat in a silica or porcelain crucible. Concentrated nitric acid (5 ml.) and A.R. potassium chlorate (0.3 g.) are added and the crucible is covered with a watch-glass and heated on a boiling water bath until solution is complete except for any silica which may be present. The solution is evaporated to dryness, 1 ml. of concentrated hydrochloric acid is added, and the solution again evaporated to dryness. The residue is then treated with 0.2N-hydrochloric acid and the solution transferred to a 60 ml. beaker, filtering through a No. 44 Whatman filter paper if necessary. The copper is then precipitated with hydrogen sulphide in the cold and, after heating on the water bath, the gas is passed into the solution again to ensure complete precipitation: the supply is then disconnected leaving the glass tube in the beaker. The copper sulphide is filtered off through a No. 44 paper and well washed with distilled water saturated with hydrogen sulphide. Traces of copper sulphide adhering to the beaker and tube are dissolved in 2 ml. of aqua regia and the beaker is heated on the water bath until effervescence ceases. The solution is then transferred to the crucible in which the filter paper containing the copper sulphide has been ashed. The beaker and tube are washed with 1 ml. portions of aqua regia, which are transferred to the crucible, the combined solution being evaporated to dryness. If the amount of copper is large the residue is dissolved in 2N-sulphuric acid, the solution transferred to a 250 ml. conical flask, filtering if necessary, and the copper is determined by Method No. 38(a). If the quantity of copper sulphide is only small the residue is taken up in 0.2N-hydrochloric acid and the solution is transferred to a 100 ml. or 250 ml. graduated flask, filtering if necessary through a No. 44 Whatman paper. The copper is then determined by Method No. 38(b).

The filtrate from the copper sulphide, containing the chromium is boiled in a conical flask closed with a pear bulb stopper until free from hydrogen sulphide. The solution is then cooled and treated successively with 100 volume hydrogen peroxide (3 ml.) and an excess of 2N-sodium hydroxide. It is then heated on a water bath until effervescence has subsided, 5 ml. of a 5 per cent. solution of nickel sulphate are added and the solution is boiled for 5 minutes, cooled and acidified with concentrated sulphuric acid (10 ml.). Chromium is then determined by Method No. 37(a).

If the quantity of chromium is small, the solution which has been boiled to remove hydrogen sulphide is cooled, acidified with 2N-sulphuric acid and made up to 250 ml. in a graduated flask. The chromium is then determined by Method No. 37(b).

**(g) Iron and copper present; chromium absent**

The sampled material (1 or 2 g.) is dried at 110° C., weighed and ashed in a muffle furnace at incipient red heat in a silica or porcelain crucible. The ash is dissolved in aqua regia, and when effervescence has ceased, the watch-glass cover is removed and the solution evaporated to dryness. The residue is dissolved in 0.2N-hydrochloric acid and the solution transferred to a 60 ml. beaker filtering if necessary. Copper is then precipitated and separated as described in Method No. 35(f).

The filtrate from the copper sulphide is boiled until free from hydrogen sulphide, the mouth of the 250 ml. conical flask being closed with a pear bulb stopper. The solution is made approximately N in hydrochloric acid and the iron determined by Method No. 36(a) if it is present in quantity. If only traces are present, the solution is cooled and made up to 100 ml. or 250 ml. in a graduated flask. The iron is then determined by Method No. 36(b).

**(h) Iron copper and chromium all present**

The sampled material (1 or 2 g. according to the anticipated content of metallic oxides) is dried at 110° C., weighed and ashed in a muffle furnace at incipient red heat. The ash is dissolved by warming with a mixture of concentrated nitric acid (5 ml.) and A.R. potassium chlorate (0.3 g.) and the solution evaporated to dryness. The residue is treated with concentrated hydrochloric acid (1 ml.) and the solution evaporated to dryness again. The residue is dissolved in 0.2N-hydrochloric acid and, after filtering off any silica that may be present, copper is separated and determined as described in Method No. 35(f).

The filtrate from the copper sulphide, contained in a conical flask closed with a pear bulb stopper, is boiled until free from hydrogen sulphide. 100-volume hydrogen peroxide (3 ml.) and an excess of 2N-sodium hydroxide are added and the flask is heated on a water bath until effervescence has subsided. The precipitated ferric hydroxide is filtered off, washed with boiling distilled water, and redissolved in hot N-hydrochloric acid. If the iron content is large, this solution is analysed by Method No. 36(a). If the iron content is small, the solution is cooled and made up to 250 ml. in a graduated flask before analysis by Method No. 36(b).

The filtrate containing the chromium as sodium chromate is acidified with 2N-sulphuric acid and, if the content is small, it is made up to 250 ml. in a graduated flask and determined by Method No. 37(b). If the chromium content is large, the solution is treated with a 5 per cent. solution of nickel sulphate (5 ml.), boiled for 5 minutes, cooled, acidified with concentrated sulphuric acid (10 ml.) and the chromium determined by Method No. 37(a).

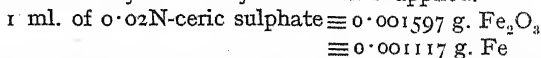
## 36. IRON

### (a) Macro-method

The solution of iron in N-hydrochloric acid is passed through a silver reductor\* and collected in a 600 ml. conical flask. The reductor is washed with 150 ml. of N-hydrochloric acid and the combined filtrate and washings titrated with 0.2N-ceric sulphate using 0.5 ml. of 0.02M-orthophenanthroline-ferrous sulphate as indicator.

The indicator is prepared by dissolving 0.3 g. of o-phenanthroline and 0.14 g. of ferrous sulphate in 250 ml. of water.

A blank titration is made on 150 ml. of the N-hydrochloric acid after passing through the reductor and any necessary corrections applied.




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\*Walden, Hammett and Edmonds. *J. Amer. Chem. Soc.*, 1934, 56, 350.

**(b) Micro-method**

An aliquot part of the iron solution is diluted to 45 ml. with distilled water in a 50 ml. measuring flask, treated with 3 drops of thioglycollic acid, and the solution mixed thoroughly. Ammonium hydroxide (2 ml.) is then added and the volume adjusted to 50 ml. A suitable depth of shade for colorimetric comparison is given by a solution containing 0.0001 g. of iron in 50 ml. The amount of the test solution to be used for the final matching should therefore be determined by preliminary comparisons with a solution prepared in this way. The comparison is made in a suitable colorimeter with the standard at a depth of 30 mm.

**37. CHROMIUM****(a) Macro-method**

The sodium dichromate solution is titrated with 0.1N-ferrous ammonium sulphate using phenylanthranilic acid as indicator.

1 ml. of 0.1N-ferrous ammonium sulphate  $\equiv$  0.002534 g.  $\text{Cr}_2\text{O}_3$   
 $\equiv$  0.001733 g. Cr

The indicator is prepared by dissolving 1.065 g. of phenylanthranilic acid in hot water containing 0.53 g. of A.R. sodium carbonate, and diluting to 1,000 ml.

**(b) Micro-method**

A suitable aliquot part of the dilute chromium solution is transferred to a 50 ml. graduated flask, diluted to 40 ml. and treated with 1 ml. of saturated bromine water. 2N-sodium hydroxide is then added drop by drop, until the yellow colour disappears and there are two drops in excess. After 1 minute 1 ml. of 0.68 per cent. phenol, 1 ml. of 0.2 per cent. diphenylcarbazine (in a mixture of acetic acid 10 per cent. and rectified spirits 90 per cent.) and 2 ml. of 2N-sulphuric acid are added in this order. The volume is adjusted to 50 ml. and after mixing thoroughly, the solution is matched against standards prepared from a chromium solution containing 0.00001 g. of chromium per ml. A depth of shade suitable for matching in the colorimeter is obtained with 2 ml. of standard chromium solution treated in the above manner and diluted to 50 ml. If possible, the volume of the test solution used should be adjusted by preliminary trials to give a depth of shade close to the standard. Should this be impossible a 1 ml. standard must be employed.

**38. COPPER****(a) Macro-method\***

Potassium iodide (2 to 3 g.) is added to the solution of copper in 2N-sulphuric acid. After 5 minutes it is diluted with distilled water and the liberated iodine titrated with 0.1N-sodium thiosulphate until the colour has almost disappeared. A few drops of a freshly prepared solution of soluble starch are then added and the titration continued until the solution is nearly, but not quite colourless. Ammonium thiocyanate (2 g.) is then dissolved in the solution and the titration continued until the blue colour disappears completely.

1 ml. of 0.1N-sodium thiosulphate  $\equiv$  0.006357 g. of copper.

If only a small amount of yarn or fabric is available or the copper content is low, 0.01N-sodium thiosulphate may be used instead. If this is done it is preferable to add the ammonium thiocyanate at the beginning of the titration.

**(b) Micro-Method**

A suitable aliquot part of the dilute copper solution is transferred to a 50 ml. measuring flask and treated successively with 10 ml. of a 4 per cent. solution of sodium pyrophosphate, 5 ml. of a freshly prepared 1 per cent. solution of gum arabic, 1 ml. of a 0.2 per cent. solution of sodium diethyldithiocarbamate and 1 ml. of 0.880 ammonia before making up to volume. The colour of the solution is matched against standards prepared similarly from a copper solution

\*Foote and Vance. *J. Amer. Chem. Soc.*, 1935, 57, 445.

containing 0.00001 g. of copper per ml. in a suitable colorimeter, a 10 ml. copper standard at a depth of 30 mm. giving a suitable average colour density.

### 39. MANGANESE

(a) **Manganese in presence of copper; no other metals being present in appreciable amount.** (Materials intended for rubber proofing).

The sampled material (10 g.) is dried at 110° C., weighed, transferred to a large crucible or silica dish and ashed at incipient red heat in a muffle furnace. The ash is dissolved in aqua regia, the solution evaporated to dryness and transferred to a small beaker with 0.2N-hydrochloric acid. Hydrogen sulphide is then passed into the solution first in the cold and again after boiling and the precipitate filtered off using a No. 44 Whatman filter paper. After washing with distilled water saturated with hydrogen sulphide, the paper is dried, ashed in a porcelain crucible and treated with a small quantity of aqua regia which has been previously used to wash the beaker and the tube used in the precipitation. After evaporation to dryness the residue is taken up in 0.2N-hydrochloric acid and the solution transferred to a graduated flask (50 ml. or 100 ml. according to the anticipated copper content) and the copper determined by Method No. 38(b).

The filtrate and washings from the precipitation of copper sulphide are evaporated to dryness, moistened with concentrated sulphuric acid and a few drops of concentrated nitric acid, and heated cautiously over a flame until fuming is observed. The residue is diluted with distilled water and transferred, filtering if necessary, into a conical flask (100 ml.), the volume being adjusted to about 30 ml. Concentrated sulphuric acid (8 ml.) and potassium periodate (0.3 g.) are then added and the solution is boiled for about 1 minute and then heated for 15 minutes on a steam bath. After cooling, the solution is made up to a definite volume according to its colour and compared in a colorimeter with a suitable standard prepared by oxidation of a standard solution of manganese under similar conditions.

To prepare a standard solution of manganese, potassium permanganate (0.2877 g.) equivalent to 0.1 g. manganese, is dissolved in 300 ml. of water, the solution being acidified with 2N-sulphuric acid (2 ml.) and treated with sulphur dioxide until decolourised completely. The excess of sulphur dioxide is then removed by boiling and the solution cooled and diluted to 1 litre. This solution is finally diluted tenfold, so that the final manganese content is 0.00001 g. per ml.

(b) **Manganese in presence of iron, chromium, copper**

Method No. 35(h) is followed up to the end of the removal of copper by means of hydrogen sulphide, with the exception that 5 g. of the material should be employed. The filtrate from the copper sulphide contained in a conical flask is boiled until free from hydrogen sulphide, neutralised with sodium carbonate, acidified faintly with hydrochloric acid, after which an excess of finely divided barium carbonate is added and the mixture shaken for 2 hours. The iron and chromium are absorbed completely in the carbonate and removed by filtration. The filtrate and washings are then evaporated to dryness, heated with concentrated sulphuric acid and a little nitric acid to remove chlorides and analysed for manganese as in Method No. 39(a).

### 40. ZINC

#### Extraction procedure

10 g. of the material, cut into small pieces and thoroughly sampled, are digested for 30 minutes with 130 ml. of water and 20 ml. of N-hydrochloric acid in a 250 ml. conical flask immersed in an actively boiling water bath. The extract is filtered by suction through a No. 1 Whatman filter paper and the material well pressed and washed with four portions of 20 ml. of boiling distilled water. The filtrate and washings are cooled and made up to 250 ml.

### Method

100 ml. of the solution are transferred to a 500 ml. conical flask and treated with 2N-ammonium hydroxide solution until just alkaline to methyl red. 10 ml. of 2N-ammonium chloride solution, 25 ml. of N-sodium acetate solution and 6 ml. of N-acetic acid are added and the solution diluted to 190 ml. with distilled water after heating to 70° C. 9 ml. of 2 per cent. oxine in N-acetic acid are added and the solution brought to the boil. The flask, loosely stoppered, is then placed on a steam bath for 30 minutes. The solution is then filtered through a No. 41 or No. 541 Whatman filter paper, the flask washed out with hot water and the precipitate washed a further three times on the filter. The precipitate on the filter and any residue adhering to the sides of the flask are dissolved in 100 ml. of boiling 2N-hydrochloric acid and the solution collected in a 250 ml. long necked flask. After cooling, 1 ml. of methyl red indicator (0.005 per cent. M.R. in 80 per cent. alcohol) is added, and 0.1 N-potassium bromate-bromide solution (2.784 g. potassium bromate and 12 g. potassium bromide per litre) is run in from a burette until the colour of the solution is sulphur yellow. A further 1 ml. of indicator is then added and the process continued until a 1 ml. portion of the indicator is decolourised immediately. This second stage of the titration should not take up more than a few ml. of the potassium bromate-bromide solution. The burette is then adjusted to a convenient mark and the reading noted. The solution is allowed to stand for 2 minutes to ensure complete bromination of the oxine and the excess bromine is then determined by adding 5 ml. of 20 per cent. potassium iodide solution and titrating the liberated iodine with 0.1 N-sodium thiosulphate solution, using a 1 per cent. solution of soluble starch as indicator. The back titration should not exceed 2 ml.

1 ml. of 0.1 N-potassium bromate-bromide solution  $\equiv$  0.0008166 g. zinc.

If the titration with 0.1 N-potassium bromate-bromide solution exceeds 35 ml. the estimation must be repeated using 50 ml. of extract solution instead of 100 ml. This is necessary only when the zinc content is greater than 0.72 per cent.

### 41. LEAD

Incinerate 10 g. of shredded material in a porcelain crucible at low temperature to avoid loss of lead by fusion into the glaze of the crucible or by volatilisation, until all carbonaceous matter is destroyed. Cool and transfer to a 100 ml. beaker. Wash the crucible with small successive quantities of dilute nitric acid (1 volume nitric acid to 2 volumes distilled water) to remove any adherent ash. Make up the solution to approximately 50 ml. with dilute nitric acid and boil for half an hour. Filter through a No. 40 Whatman filter paper into a 600 ml. beaker and wash the beaker and filter paper with hot distilled water. Add 5 ml. of concentrated sulphuric acid (A.R.) to the filtrate and evaporate the solution until sulphuric acid is freely evolved.

Cool, add cautiously about 150 ml. of distilled water and boil the solution for five minutes. Allow to stand overnight at laboratory temperature.

Filter the precipitate through a No. 42 Whatman filter paper and wash several times with 2 per cent. sulphuric acid solution. Boil the paper and precipitate with 20-30 g. of ammonium acetate dissolved in 50 ml. of distilled water in a tall 250 ml. beaker for about half an hour. Filter through a No. 40 Whatman filter paper into a tall 250 ml. beaker and wash the filter paper thoroughly with hot distilled water.

Pass hydrogen sulphide into the filtrate for 10 minutes, stand the beaker on a water bath to coagulate the precipitate of lead sulphide and re-saturate with hydrogen sulphide. Cool and filter through a No. 42 Whatman filter paper and wash with hydrogen sulphide water. Dissolve the precipitate in hot dilute nitric acid and wash the filter paper with hot distilled water. Collect the solution and washings in a 600 ml. beaker and add 5 ml. of concentrated sulphuric

acid (A.R.). Evaporate to fuming, dilute boil and allow to stand overnight as before.

Filter the precipitate on to a G.4 sintered glass crucible (previously washed with hot ammonium acetate solution then hot distilled water, dried at 130° C. and weighed). Wash thoroughly with 2 per cent. sulphuric acid and then finally with methylated spirit. Dry at 130° C. to constant weight.

Extract the contents of the crucible thoroughly with hot ammonium acetate solution and finally wash with hot distilled water. Dry at 130° C. and re-weigh.

Calculate the amount of lead sulphate (the difference between the weight of the crucible before and after extraction with ammonium solution) to percentage metallic lead on the sample.

## 42. PARANITROPHENOL

### Extraction procedure—Solution "A"

A sample, roughly 10 g. of the material to be analysed is cut up into  $\frac{1}{4}$  in. squares. These are mixed well and 2.66 g. (equivalent to 2.50 g. dry cloth) are placed in a glass stoppered 100 ml. conical flask, 50 ml. of N-10 sodium hydroxide are added and the whole weighed.

A glass pear bulb is then substituted temporarily for the stopper and the alkali is just brought to the boil in order to wet out the cotton thoroughly. After cooling, the glass stopper is replaced, the weight adjusted to the original, and the flask is shaken at intervals over about an hour to complete dissolution of the paranitrophenol.

### Solution "B"

A stock reference solution is prepared by dissolving 0.375 g. of paranitrophenol in water containing 1.35 ml. of 2N-sodium hydroxide and making up to 100 ml. This is diluted 100 fold as required to give the reference solution for use in the analysis.

### Method

20 ml. portions of solutions A and B are placed in 25 ml. graduated flasks, neutralised to disappearance of the yellow colour with 2N-acetic acid, and an additional 2 ml. of the acetic acid added to each. The volumes are then made up to 25 ml. and 1 g. of zinc dust is added to each flask, after which they are shaken at intervals over an hour, releasing liberated hydrogen when necessary. The contents are then filtered (Whatman No. 1 paper) and aliquot portions of 1, 2 and 4 ml. are pipetted into 100 ml. boiling tubes, followed by 2.5 ml. of a 1 per cent. solution of sodium orthocresate, water to bring the volume to 45 ml. and then 5 ml. of 2N-acetic acid in the order given. The contents are stirred very thoroughly with a glass rod, and the tubes closed with pear bulbs, are kept overnight to attain full development of the indophenol blue colour.

The reference solutions and as many of the test solutions as come within their ranges are finally compared in a suitable colorimeter.

The technique described covers a paranitrophenol content of the cloth ranging from 0.02 to 0.3 per cent.

## 43. SHIRLAN

5 g. of the material to be analysed shall be cut up into small pieces, well mixed, and portions of 0.5, 0.25, and 0.125 g. are weighed into 3 in.  $\times$   $\frac{3}{4}$  in. specimen tubes.

Eleven lots of 0.5 g. of similar material (i.e. grey or bleached but free from Shirlan) are then weighed similarly to provide references.

5 ml. of 4 per cent. borax saturated with cyclohexanol are added to the material to be analysed; and 5 ml. of solutions of Shirlan in 4 per cent. borax saturated with cyclohexanol, the quantity of Shirlan being varied to give a suitable range, to each of the references. All of the tubes are then stirred intermittently with a glass rod for about an hour. After this 1 ml. from each of the tubes is transferred to a 4 in.  $\times$  1 in. specimen tube; 0.5 ml. of a suspension



of 2:6 dibromquinone chlorimide in 4 per cent. borax saturated with cyclohexanol is added to each, and they are mixed thoroughly. A disc of bleached cloth (diameter less than 1 in.) is then placed in each of the tubes and they are agitated at intervals over about an hour. The discs are then removed, washed gently in a dilute solution of borax, transferred to a white tile and covered with a glass plate. The Shirilan content is estimated by comparing the depth of colour of the disc from the sample that is being analysed with those of the discs from the reference.

With 0.5 g. of material, 5 ml. borax solution, 1 ml. of extract and 0.5 ml. of the dibromquinone chlorimide suspension, the procedure is sensitive to within 10 per cent. for Shirilan contents up to 0.05 per cent. Larger contents of Shirilan may be dealt with by taking a smaller quantity of the sample for analysis and/or by using more than 5 ml. of the borax solution for extraction.

For most purposes the range of solutions of Shirilan used to treat the controls is as follows:—0.005, 0.0045, 0.004, 0.0035, 0.003, 0.0025, 0.002, 0.0015, 0.001, 0.0005, 0.0002 per cent.

These correspond to Shirilan contents of cloth ranging from 0.05 per cent. down to 0.002 per cent.

In order to obtain satisfactory results it is necessary to reduce the particle size of the D.Q.C. by grinding with a little of the borax-cyclohexanol solution.

#### 44. PENTACHLORPHENOL

##### General

It has been found that pentachlorophenol can be removed completely from cotton by means of a solution of borax, and that in order to avoid so far as possible, interference with the colour of the copper derivative, it is essential that the pentachlorophenol should be distilled in steam prior to analysis. The accuracy of the two methods is reasonable ( $\pm 5$  per cent.) and they have been applied satisfactorily to the analysis of a number of undyed and variously dyed cotton yarns and fabrics, and to paper proofed with pentachlorophenol.

##### Preliminary separation

The yarn or fabric (5 g.) previously cut into small pieces, is placed in a 300 ml. round-bottomed short-necked flask and treated with 100 ml. of a saturated solution of borax, using a filter pump to ensure thorough wetting of the material. The flask is then placed in a steam bath and the contents are maintained at about 50° C. for 15 minutes, with frequent shaking, after which the residual cotton is collected in a Buchner funnel, and washed repeatedly with a dilute solution of borax. The extract and washings are transferred quantitatively to a 500 ml. long-necked flask fitted with a spray trap and a vertical double-surfaced condenser, acidified with hydrochloric acid, diluted to about 300 ml. and distilled until 200 mls. have passed over, the distillate being collected in a separating funnel.

##### Method

The distillate is shaken with three successive portions (total 30 ml.) of chloroform, using the first to dissolve any adhering solid from the condenser. The combined extracts are shaken thoroughly with 50 ml. of distilled water and 2 ml. of a 3 per cent. solution of copper sulphate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) in a 40 per cent. aqueous solution of pyridine. The chloroform layer is run off into a 50 ml. measuring flask and the blue aqueous layer shaken with further small amounts of chloroform. The combined extracts are made up to 50 ml. and compared in a suitable colorimeter with an appropriate standard prepared similarly from a 0.2 per cent. solution of pure pentachlorophenol in chloroform.

#### 45. EXTENDED SOLUBILITY TEST

##### General

This test is intended to be applied to materials proofed with organic anti-septic such as paranitrophenol, Shirilan, pentachlorophenol, etc.

### Testing

A 10 gm. sample of the material is cut into pieces approximately half an inch square, which are then placed in a glass tube about 6 in. long and 1 in. in diameter.

This tube (T) is fitted to the continuous syphon apparatus shown in the accompanying sketch.

The Winchester bottle (A) is filled with 2 l. of distilled water (pH 6.7 to 7.3) and syphoning is started by blowing down the air inlet tube at C. The screw clip is adjusted so that 20 drops of water per minute pass from the apparatus.

The 2 litres will thus require 48 hours to run through the material.

### Performance

The amount of organic antiseptic which is removed during the test is determined by estimating the concentration on the material before and after extraction with distilled water. The quantity of antiseptic removed must not be so great as seriously to interfere with the proofing on the material, which before and after extraction, must be subjected to test No. 46(a).

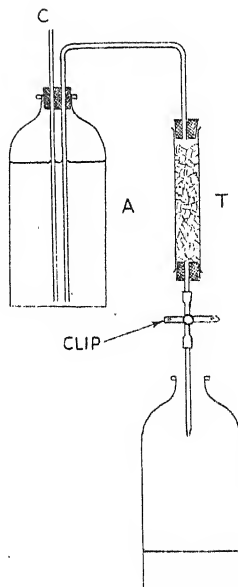


Fig. 5

## 46. PERFORMANCE TESTS FOR PROOFINGS AGAINST ATTACK BY MICRO-ORGANISMS.

### Foreword

Conformity with a chemical specification does not necessarily mean that the material is proofed against attack by micro-organisms. It is therefore recommended that the chemical estimations be supplemented by a simple qualitative mycological test.

The first of the following tests is intended for application to materials which, under service conditions, are unlikely to come into prolonged contact with soil.

In some instances, however (e.g. sand bags and the valances of tents), the material is liable to attack by both airborne and soil micro-organisms. It is recommended, therefore, that in those cases where the fabrics will, under service conditions, come into prolonged and intimate contact with soil, a microbiological test, in which the effectiveness of the proof against both these forms of attack can be judged, should be prescribed by the specification.

These tests shall be carried out on both leached and unleached material. In the case of organic antiseptics, the leached material is that which has undergone the extended solubility test, whilst in the case of inorganic proofing agents leached material is that which has undergone some form of weathering or accelerated weathering test.

### (a) Test for the Effectiveness of a Proof against Air-borne Microbiological attack

At least two samples (approximately 2 x 2 inches each) of the proofed fabric, together with two samples of untreated fabric, are placed in Petri dishes, and each sprayed with 5 ml. of an aqueous suspension of cellulose-decomposing fungal spores taken from a mixed culture which should contain the following species: *Penicillia*, *Aspergilli* (e.g. *Aspergillus fumigatus*, and *Aspergillus glaucus*), *Cladosporium herbarum*, *Rhizopus nigricans*, *Memnoniella echinala*, *Chaetomium globosum* and *Metarrhizium anisoplia*.

The inoculated samples in the Petri dishes are placed above water in a desiccator, the tap of which is left open, and the desiccator is then stored at 25°-30° C.

If, after 21 days' incubation, the untreated material is covered with fungi, whilst the treated material is completely unaffected, the proof can be considered satisfactory.

(b) **Test for the Effectiveness of a Proof against both Air-borne Microbiological attack and Soil Bacterial attack**

A thin aqueous sludge of a mixture of 2 parts unsterilised soil and one part horse dung is prepared, and the surfaces of Berkfeld filter candles (preferably at least  $6 \times 2$  inches) are impregnated by immersing the candles in the sludge and drawing the liquor through the candles by means of a suction pump. A thin film of inoculum rich in both air-borne micro-organisms and soil bacteria is thereby obtained. Strips of the proofed material are wound round the filter candles which are then fixed in glass jackets and incubated at  $25^{\circ}\text{C}$ . and 92-95 per cent. R.H. for 21 days. Control samples of untreated fabric are tested in a similar manner. After 21 days, the treated sample must be free from fungoid growth. The samples are carefully unwound, washed in running cold water, air-dried, and conditioned in the standard atmosphere for 24 hours. They are then tested for tensile strength. The untreated control samples shall have lost at least 90 per cent. of their initial tensile strength. The loss in tensile strength of the proofed samples not be more than 10 per cent. of its initial value.

NOTES.—This test has the following advantages over a soil burial test:—

It gives more reproducible results.

It more nearly reproduces service conditions in that the outer surface of the fabric is exposed to the air, whilst the inner surface is in close contact with a rich inoculum of soil bacteria.

Unlike the soil burial test, it enables visual results of microbiological attack to be observed.

#### 47. PERFORMANCE TESTS FOR FLAME-PROOFING AND SMOULDER-PROOFING

##### Apparatus

It is strongly recommended that the apparatus for these tests shall conform in its essential features to the following description:—

(1) The platform for the test specimens shall consist of a frame of wood or metal on which are mounted a series of nichrome wires 28 s.w.g. at 1 in. centres, to form a grid for supporting the fabric throughout its length. The frame is graduated in inches along its front edge to facilitate reading of results, the graduations proceeding from the third wire (from the bottom), which is marked zero. The frame shall have an internal width of  $6\frac{1}{2}$  ins., and shall be sufficiently long to accommodate 21 wires in all.

(2) The baseboard on which the specimen platform is suitably mounted, shall be provided with sides and back of ample height, but no front or top. The whole is finished in matt black.

(3) The igniting cup shall be of iron, steel or copper, about  $\frac{1}{2}$  in. thick, and shall be  $\frac{1}{8}$  in. external diameter and  $\frac{3}{32}$  in. high. The cup shall be mounted on cork or other material of low thermal conductivity.

The sketch illustrates the above features, and shows the specimen platform hinged to the base and supported at an angle of  $45^{\circ}$  by a movable arm. It can thus be lowered for easier attachment and removal of the test specimens, and can also be adjusted to other angles of slope if required, by the provision of suitable additional supports, as the smaller one shown in the sketch.

The ignition cup is shown mounted on cork on the head of a screwing arrangement so that its height can be adjusted.

##### Testing Procedure

Specimens of fabric 24 in. long shall be prepared and conditioned as described on page 2.

Fabric up to 6 in. wide shall be tested whole width.

For fabric wider than this, 6 in. strips shall be prepared.

The test pieces are fixed centrally on the specimen platform and secured at top and bottom by means of drawing pins or other suitable means.

Only one specimen of fabric shall be tested at a time irrespective of width.

In the absence of specific instructions to the contrary it is recommended that all tests shall be carried out with the fabric platform at an angle of  $45^\circ$ , and with the ignition cup placed at a vertical distance of 1 in. below the centre of the third (zero) wire.

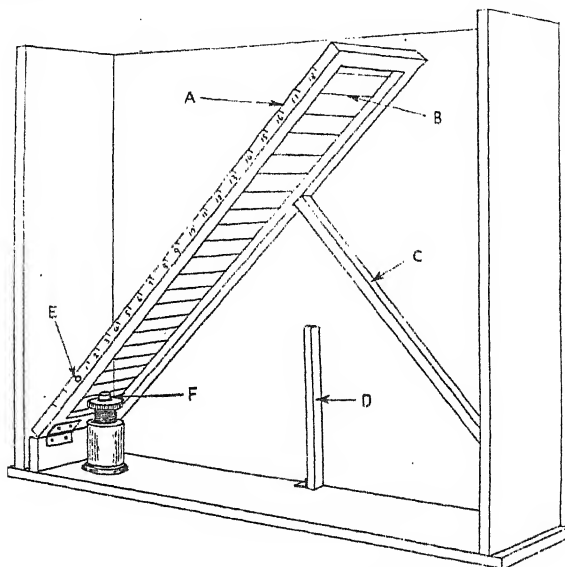


Fig. 6. Flame-proof and Smoulder-proof Apparatus

A—Specimen platform supported at an angle of  $45^\circ$ . B—Nichrome wires 28 s.w.g. at 1" centres. C—Movable support. D—Extra support if special angle of slope is required. E—Zero mark, F—Ignition cup on screw head.

For each test 0.3 ml. of absolute alcohol shall be poured into the cup from a suitable pipette or burette. The cup is then immediately placed in position and the alcohol ignited by means of a small (bead) gas, or oil jet, or by other suitable small source of heat, which is removed as soon as the alcohol is ignited.

During testing, draughts are excluded, if necessary, by a glass shield placed in front of the apparatus.

The greatest possible accuracy in assessing the results shall be ensured by carrying out the tests in reasonably subdued light, although a dark room is not essential if the apparatus has a good black finish.

An interval of  $2\frac{1}{2}$  minutes shall be allowed to elapse between each test.

Before testing, 0.3 ml. of absolute alcohol shall be burnt in the ignition cup and an interval of  $2\frac{1}{2}$  minutes allowed afterwards, before commencing the first test.

#### Definitions

A material is *flame-proof* when it does not continue to flame after the source of heat is withdrawn.

A material is *smoulder-proof* when it does not continue to smoulder after the flame has died out.

#### Performance

**Flame-proof.** The material specification shall prescribe the maximum permissible time (if any) for continuance of flame, after the source of heat has been removed; and may also prescribe permissible limits (if any) for the extent of scorching or charring.

**Smoulder-proof.** The material specification shall prescribe the maximum permissible time (if any) for continuance of glow after the disappearance of the flame.

## Part IV

### COLOUR FASTNESS TESTS

#### 48. FASTNESS TO LIGHT

The method described in British Standard Specification No. 1006, 1942, shall be used.

NOTE.—It is considered essential that the appropriate Standard or Standards should be exposed with each test.

#### 49. FASTNESS TO WASHING

The tests and machine recommended in the report of the Fastness Committee of the Society of Dyers and Colourists, 1934, page 35, shall be used, with the following modifications:—

(1) The materials under test shall be sewn to a piece of white unmercerised cotton limbric or cambric, 4 × 4 in. (10 × 10 cm.) so as to cover the whole area.

(2) The volume of the test liquor shall be 250 ml. in all cases.

(3) The dyed Standards prescribed in the above report (page 36) have not proved adequate, and cannot now be recommended.

The tests shall be carried out against a portion of the "Sealed Sample."

NOTE.—It must be recognised that many materials coming within the category of narrow fabrics are not washed in practice. It is therefore recommended that the above washing tests be included only in those specifications where washing fastness is an important property of the material.

#### 50. FASTNESS TO BLEEDING AND MARKING OFF

The general method is as follows:—

A test piece about 2 in. (5 cm.) long, covered on one side with a piece of white unmercerised cotton fabric, and on the other side with a white woollen fabric of the same dimensions, shall be placed on the bottom of a flat glass or porcelain dish about 4 ins. (10 cm.) in diameter, with the white cotton fabric uppermost.

The dish shall then be flooded with test liquor without disturbing the assembled materials. After allowing to soak at room temperature for 15 minutes, the materials shall be covered with a smooth glass plate weighing approximately 50 g. Light and even pressure shall be applied on the plate with three fingers, and the excess liquor poured off.

The materials shall then be treated at the temperature and for the time prescribed below, after which they shall be removed from the dish and allowed to dry at room temperature without separation.

When dry, the test piece shall be examined for loss in depth and change in shade, and the white materials for staining.

This general method shall be used with the corresponding modifications when testing for fastness to the following agencies:—

##### 1. Cold Water (Rain)

The test liquor shall be distilled water at 20°-25° C. The duration of treatment shall be 24 hours.

##### 2. Water at Body Temperature

The test liquor shall be distilled water at 37° C. The duration of treatment shall be 4 hours.

##### 3. Perspiration

The test liquors shall be those prescribed in the report of the Fastness Committee of the Society of Dyers and Colourists, 1934, page 27, and the tests shall

be carried out with both the acid and the alkaline perspiration liquors. The temperature of treatment shall be 37° C. and the duration of treatment shall be 4 hours.

NOTE.—All bleeding and marking off tests shall also be carried out against a portion of the "Sealed Sample."

#### 51. FASTNESS TO DECONTAMINATION

The test piece shall be kept immersed in 50 times its own weight of boiling distilled water for 3 hours, and after drying, it shall be examined for loss in depth and change in shade.

NOTE.—The test shall also be carried out against a portion of the "Sealed Sample."

#### 52. FASTNESS TO RUBBING

A test piece about 5 in. (13 cm.) long shall be secured without tension to a flat smooth wooden surface, and strongly rubbed 10 times to and fro over a distance of 4 in. (10 cm.) with a white cotton cambric wrapped round the forefinger.

##### 1. Dry Test

The white cotton cambric shall be used dry.

##### 2. Wet Test

The white cotton cambric shall be wetted, and then squeezed so as to contain approximately its own weight of water.

NOTE.—All rubbing tests shall also be carried out against a portion of the "Sealed Sample."

# THE JOURNAL OF THE TEXTILE INSTITUTE

## STANDARDISATION

### CLOTH STRENGTH TESTING—IX

#### EXAMPLES OF INERTIA ERROR IN TEST RESULTS FROM PENDULUM BALANCE TENSILE TESTING MACHINES

By A. W. BAYES

#### INTRODUCTION

This paper describes further work on one of the errors in cloth strength testing. The waviness of load-extension curves drawn by pendulum balance strength testing machines is well-known. Shorter & Hall<sup>1</sup> and Peirce<sup>2</sup> have suggested that the errors associated with this waviness do not attain serious proportions in practice, but their work was confined to single-thread andlea testers. Cloth testing machines of the pendulum balance type have usually much heavier pendulum systems and a faster rate of traverse, and the test specimens are usually much shorter. Paper IV by Martindale & Woods in this series<sup>3</sup> extends the analysis made by Shorter & Hall and shows that serious errors due to the inertia error of the pendulum system are to be expected under certain conditions, namely, with normal Goodbrand machines with 18 inches per minute rate of traverse, testing linen or cotton in 7 inch specimens. The largest errors occur with the weakest specimens and errors are quoted ranging from 30 to 49 per cent. for linen specimens and from 15 to 20 per cent. for cotton specimens. These are estimates from theory of the maximum possible inertia errors and the authors point out that the average errors in practice may be smaller due to non-observance of Hooke's law and to positive and negative errors cancelling.

The reports of various researches explain that testing machine conditions were chosen in which the pendulum jerks had died away before the break, but in others it is obvious that conditions liable to serious inertia errors had been used. In routine testing, machines are used for a wide range of fabrics and some tests are done in which the specimens break after only one or two jerks of the pendulum. The inertia error may, therefore, be important in practice and the present paper presents some evidence of this.

Peirce, Turner, Matthews & Barr have discussed the effect of specimen dimensions on the tested strength of yarns and fabrics. It has been shown by "the weakest link" theory<sup>4</sup> that long specimens must tend to be weaker than short ones and that the strength per unit width is likely to fall as the width of specimen is increased, but it has been suggested<sup>5</sup> that very narrow fabric specimens may be less strong comparatively, and<sup>6</sup> that in some circumstances, if a wide enough range of widths of test specimen could be used, with continuously increasing width, the strength might be expected to increase, decrease, increase and again decrease. Little experimental evidence was put forward in support of these last two suggestions. The weakening of very narrow specimens could occur only once in a series of various widths and the alternate increasing and decreasing is said to require a wide range of widths. No one seems to have suggested that large increases and decreases in strength, occurring between quite small changes in width, could be due to the dimensions of the test specimens.

The jerky movement of the pendulum can be observed easily enough without an autographic recorder. The indicating pointer can be seen to hesitate, and the number of jerks before the break can be counted. On autographic traces the jerks appear with great regularity. It has been shown that these jerks correspond with the theoretical inertia error waves. The object of the present paper is to examine breaking load data for evidence of variations in accordance with the spacing and violence of the jerks. It is assumed that variations in strength per unit width, occurring more or less regularly, at about the spacing, and of about the same magnitude, as would be predicted from Martindale & Woods's formulæ, are, in fact, due to those inertia errors which they analysed. It would be possible to change the spacing of the jerks or waves by altering the traverse speed, or the extensibility of the material tested, or the characteristics of the pendulum, and so to demonstrate whether or not the jerks followed the theory. Alternatively, a variety of materials and testing conditions could be used. The second alternative covers the various machines and materials of practical interest, and is, therefore, to be preferred for the present purpose.

Theory has shown that at a particular jaw speed a pendulum should follow a regularly repeating cycle of acceleration and deceleration. Experiments with weights<sup>7</sup> have shown that the cycles occur, and are associated with inertia errors in the recorded load. Textile specimens introduce variations by changes in extensibility, which affect the head jaw speed, and changes in strength which affect the point in the pendulum cycle at which the specimens break. When the specimens break within the second or third cycle normal variations in extensibility and strength are not likely to mask the inertia effect, but as the number of cycles increases variations in extensibility may mask the effect completely and variations in strength may complicate the analysis. In such series the effect may show up as a cyclic variation in apparent variability of the strength rather than in cyclic variations in mean strength.

Two sets of published data have been found suitable for the present study. The paper then proceeds to experiments designed specially to test the inertia error. Estimates of the period and magnitude of the inertia error were made from the testing machine particulars and the data were subjected to statistical analysis. In all the experiments the normal variability of the material makes it difficult to obtain obvious proof of the error and some of the experiments and analysis may appear somewhat inconclusive, but it is believed that, taken together, they form a considerable body of evidence in support of the conclusions of the theoretical analysis.

The practical question to be answered is: given a particular fabric and set of testing conditions, what error is being introduced by the machine. To answer this three experimental methods may be employed:

- (a) The starting position of the pendulum may be advanced a small amount at a time from zero and the mean strengths and the standard deviation for each starting point compared,
- (b) the strength of the specimen may be varied in small increments, e.g. by varying the width of the specimen; then the variation in mean strength per thread, or per unit of width, should show the extent of the inertia error.
- (c) The specimen width and length may be varied simultaneously.

One difficulty with the second method on normally extensible material is that specimens of any width have practically the same extension at break so that the testing machine behaves differently as the specimen width is changed, and the experimental points are not in fact traversing that error wave in which the normal break occurs. This difficulty may be overcome to some extent by varying the specimen length, between the jaws, and the width together, as in method (c), but as the load-extension curve is not usually straight the speci-



men lengths should be adjusted accordingly. This makes the experiment more complicated and rather less objective.

No doubt the experiments could be simplified by using more regular material such as filament rayon or wire, but the error is most obvious on the less extensible linen and cotton fabrics and, anyway, the aim is to demonstrate the practical importance of the error in normal testing.

#### Examination of some Data published by Matthew, on Linen Fabric

Matthew<sup>8</sup> has described an extensive series of tests on specially woven linen fabrics in which changes in the number of threads per inch in warp and

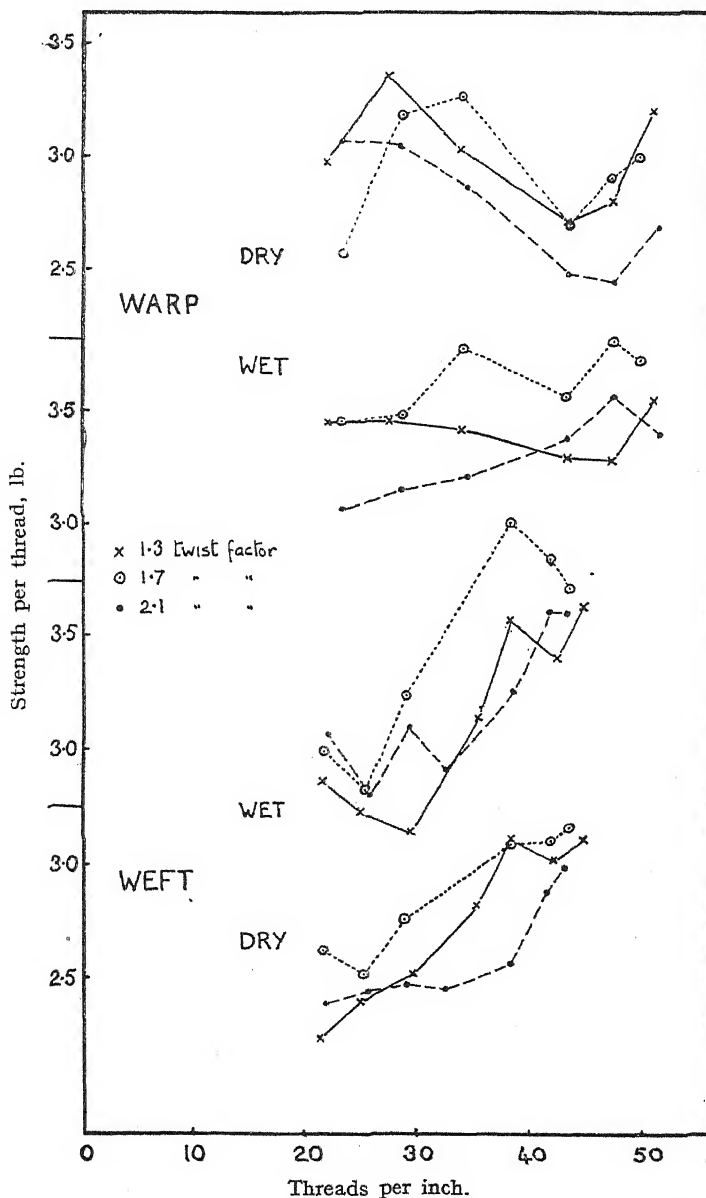


Fig. 1. Variation of strength per thread with the number of threads tested. Linen fabric tested dry and wet (Matthew's data).

weft were made and the effects of these changes were investigated by tensile and other tests. The tensile tests were made on a pendulum balance machine and the author noticed, in one series, an unexpected undulation in the graph when the strength per thread was plotted against the number of threads tested. In his own words: " . . . . . as the number of warp threads is increased the cloth strength per single end increases to a maximum and is followed by a decrease to a minimum, when the strength again increases. The possibility of the effect being due to chance, or errors due to cloth variation, or sampling, appears to be definitely discounted in view of the close similarity in the results from three independent sets of fabrics. So far as the writer is aware there is no previous record of this effect. It is evidently an outstanding feature of the results and therefore it may be presumed that it could be used as a conclusive check on any proposed theories as to the interpretation of the meaning of tensile test results in terms of cloth structure and yarn strength." The data which gave rise to these remarks were obtained on the lines of method (c) so it may be worth while to consider whether the wave noticed by Matthew was due to some curious interaction of cloth structure and yarn strength as he suggests, or to the inertia error of the pendulum system in the testing machine. The testing machine used for these experiments was a Goodbrand horizontal model, 1,000 lb. capacity, with a nominal machine rate of load of 1,100 pounds per inch. The jaw speed was reported as 20 inches per min. The jaws were set 7 inches apart. The specimens ranged in strength from about 100 to 360 lb. From Martindale & Woods's analysis large inertia errors are to be expected under such circumstances. The test material consisted of three series of specially woven and laundered samples of plain linen cloth, made from  $2\frac{1}{2}$  lb. dry spun line, in which the warp ends per inch were varied while the picks were kept approximately constant, and then the picks were varied while the warp ends were kept constant. The changes in thread spacing produced changes in crimp, which in turn produced proportional changes in extension at break. The three series differed in yarn twist factor. All specimens were frayed down to two inches wide. Twelve strips were tested from each sample after conditioning at 75% R.H. and a further twelve were tested after soaking in cold water for 30 minutes. The author has reported mean strengths for dry strips and the percentage increase resulting from wetting, and has plotted the breaking strength per thread for the dry tests against the threads per inch for each twist factor, in his Fig. 8. Of the four sets of graphs plotted therein we are interested in the warp tests with the weft threads per inch kept constant and the weft tests with the warp threads kept constant. The dry warp test graph reproduced at the top of Fig. 1 shows a distinct wave form in all three twist factors, but the dry weft test graph shows a more or less steady rise in strength as the threads per inch are increased. But when the wet strengths are calculated and plotted similarly, the shapes of the graphs are altered; the wet weft now showing what may be part of a wave and the wet warp an upward trend in two of the lines.

The range of strengths from the highest twelve test mean to the lowest for each graph is as follows:

Twist factor of yarn	Range of strength per thread, lb.	
	Warp, dry specimen	Weft, wet specimen
1.3	0.64	1.00
1.7	0.69	1.13
2.1	0.62	0.81
Average range ...	0.65	1.00
Average strength ...	2.93	3.25
Average range % ...	22.2	30.8

Table II of paper IV<sup>3</sup> of this series gives figures for the maximum possible inertia error for linen fabric tested on a machine similar to that used by Matthew, and quotes an error of 35 per cent. at a breaking load of 200 lb., so the maximum possible inertia error is large enough to account for the whole of the range of strength found in these experiments.

An explanation has still to be given for the curious effect of wetting on the shape of the graphs. Matthew pointed out that the effect of wetting was very irregular; increases in strength were recorded ranging from 2.8 to 45.9 per cent. Now the overthrow occurring at the break depends on the value of the breaking load and on the speed of the head jaw, and the speed of the head jaw depends upon the extensibility of the test specimen. It should, therefore, be possible to break specimens at any point in the overthrow cycle by modifying either the strength or the extensibility of the test specimen, but when they are altered together, the effects may cancel, wholly or in part. When the effects oppose one another the wave length of the inertia error cycle will increase and, in a short range of conditions as employed in the present tests, approximately straight line graphs of varying slope will be produced. But when the effects support one another, clearly defined waves are to be expected. It follows from this that a change in the relationship between strength and extension for a particular sample, such as occurs in wetting, may change the graph from a straight line to a wave, and vice versa. If this is the true explanation, the variation in the extent of the strength change, apparently due to wetting, is really due to changes in the inertia error.

#### **Examination of some Data published by Richardson, Bailey and Conrad, on Fibre Bundle Tests**

The simplest extension of the foregoing experiment with weights,<sup>7</sup> is to one employing specimens of negligible length, or of negligible extension. Such very short specimens are used in the Chandler bundle test for cotton hair strength, and a similar technique has been proposed for flat bundles of staple fibre.<sup>9</sup> In both a bundle of fibres of necessarily varying size is broken in special jaws fitted on an ordinary lea tester. The jaws are practically touching, so the headjaw moves almost at the same speed as the pulling jaw, and the varying size of bundle produces breaking loads of varying amount, which, when reduced to strength per fibre unit, should show an inertia error wave similar to that found with weights.

The Chandler bundle test is described in detail in one of the American Society for Testing Materials Standards on Textile Materials.<sup>10</sup> This specification states "a pendulum type testing machine having a capacity of 150 lb. shall be used. The pulling clamp shall have a speed of  $12 \pm \frac{1}{2}$  in./min. . . . Breaking loads shall be tabulated from 50 to 100 lb." The details of the test were investigated at length by Richardson, Bailey and Conrad.<sup>11</sup> They tabulated the bundle strengths of six different cottons measured on about thirty bundles of varying size. Their figures are analysed below in a manner which shows that large systematic overthrow errors are present. Though their machine was of greater capacity than that specified, similar, though possibly smaller, errors are to be expected with the specified capacity.

The technique employed by these workers was as follows: The bundles of fibres were prepared by combing in a standardised manner and each bundle was tightly wrapped with cotton thread in special apparatus. The wrapping proceeded from each end simultaneously towards the middle till the threads touched, then outwards to the ends again. The length of thread used in wrapping was measured and from this length and the thread diameter the "corrected circumference" of the bundles was calculated. The authors give a photograph of their "yarn skein tester adapted for attachment of the special jaws," which appears to be a normal Scott, vertical model, motor driven, pendulum balance, lea tester with the usual ratchet quadrant and pawls on the pendulum lever. The special clamps for gripping the specimen were carried

on extension pieces which appeared to fit directly on the top and bottom hooks of the machine. Apparently the machine capacity was 300 lb. and the jaw speed was 12 inches per minute, although these details are not given specifically.

The paper includes a correlation chart, constructed from a large number of bundle tests, which shows that the density of the bundles decreased as the bundle circumference increased. A regression line is shown on the chart joining the following limits:

Density, gm./c.c.	...	1.61	...	1.31
Circumference, ins.	...	0.095	...	0.170

Having made this point the authors pass on to study the variation of strength with bundle circumference and do not use the regression line further. Whether or not this was the best course for their subsequent analysis our present purpose is better served by applying their regression equation and reducing their breaking loads to breaking stress, in pounds per square inch, at constant bundle density. The data has been re-arranged accordingly by calculating the cross sectional areas from the circumferences, taking the densities from the regression equation, and correcting the breaking stress at the estimated density to breaking stress at a density of 1.55 gm./c.c. (the value quoted by other workers for the density of cotton cellulose).

Assuming that any particular recorded breaking load contains an inertia error of an amount which is unknown, but which is constant for that breaking load, the differences in mean breaking stress between the six samples may be disregarded. The first step in the analysis was, therefore, to express all the breaking stresses as stresses relative to the sample mean. Then the data were collected in groups of similar recorded breaking load, in five pound increments, from 74½ up to 159½ lb. Outside this range the data were too scanty for convenient analysis.\*

Table I gives the arrays obtained in each group. There are 17 groups covering 189 test results. The arrays in Table I show a general curvilinear trend and a variation in array means along the trend, and we wish to test whether the variation of the array means about the trend is statistically significant.

A third order regression line, fitted to the weighted array means by the method of least squares, had the following formula:

$$Y = -1.0716 - 0.032104X + 0.054645X^2 - 0.0064727X^3$$

where Y was the relative breaking stress measured from an origin of 100 and X was the central value of the breaking load group measured in 5 lb. units from an origin of 117 lb. The variance was then analysed into three parts, namely, the variance due to the regression line, the variance between array means and the corresponding regression line values, and the within array variance. The results are given in Table II.

The ratio of the mean square of the deviations of the array means to the residual mean square is 3.73, which is considerably greater than the 1 per cent. point given in the ratio tables for the Z test, so there is statistical confirmation of the reality of the wavy or zigzag variation in bundle strength shown in Table I.

The shape of the general trend is probably due to the use of the original authors' straight regression line for bundle density and circumference. The third order regression line fitted to the array means of Table I curves from 77 lb. to 107 lb. breaking load and then is practically parallel to the breaking load axis up to the limit of the data. Of the bundle densities calculated for

---

\* One low breaking load in lot 4, two low values in lot 6 and twelve high values out of lot 1 were thus left out of the analysis. The effect of this is to make the relative lot means differ from 100 and so to introduce a small between lot mean variance. This has been disregarded in the statistical analysis so the residual mean square in Table II is slightly enlarged.

**Table I**  
**Recorded Breaking Load and Relative Breaking Stress of Chandler Bundle Specimens**

Data from Richardson, Bailey and Conrad<sup>11</sup>.

Relative breaking stress	Breaking loads in pounds. (Central values)																	Total
	77	82	87	92	97	102	107	112	117	122	127	132	137	142	147	152	157	
87									1									1
8									—									—
9							1		—									1
90							—		—									—
1						1	—		—									1
2						—	—		—									—
3						—	1		—	1	2							4
4			2			1	—		—	—	—			1				4
5		1	—	1		1	3		1	—	1	2		—	2			12
6		—	1	—		—	1		1	—	2	—		1	—			6
7		1	1	2		1	3	2	1	2	1	3		—	2	2		21
8		—	—	1		2	2	—	—	2	1	1		—	—	—		9
9		1	2	1		1	1	1	1	2	2	—	1	2	2	1	1	19
100		2	1	—	1	4	1	1	—	1	1	2	4	1	1	1	2	23
1		3	1	1		2	—	—	—	2	—	—	—	—	1	—		12
2		6	2	—	1	2	2	—	1	—	—	—	1	—	—	—		15
3	1	4	1	—	2	3		2	3		—	3	2		1			22
4	—	1	—	3	—	—		1			—	—	—			1		8
5	—	—	1	—	1	1	1				—	—	2	1				7
6	—	1	—	—	1	1	1				—	—						3
7	—	2	—	1	1	1					—	—						7
8	—	—	1	1	3						—	—						4
9	—	1			1						—	—						2
110	3	1									1							5
1	—	—																1
2	—	—																—
3	—	—																—
4	—	—																—
5	—	—																—
6	—	—																—
7	1																	1
Total ...	10	23	14	10	14	21	15	7	9	10	12	13	9	5	9	5	3	189

**Analysis of Variance of Relative Breaking Stress, units (1 per cent.)<sup>3</sup>**

Source	Sum of squares	Degrees of freedom	Mean square
General trend (3rd order regression) ...	890.075	3	296.69
Deviation of array means from general trend...	691.360	13	47.64
Residual within arrays ...	2194.803	172	12.76
Total ...	3776.238	188	—

bundles breaking below 100 lb. half were higher than 1.55 gm./c.c., but it is unlikely that the method of wrapping employed compressed the smaller bundles beyond the normal density of cotton cellulose. The regression line gives a density of 1.55 and over for bundle circumferences of 0.111 in. and below. Evidently the correction is unreliable for this range.\*

\* A.S.T.M. Designation, D414—40T Tentative Methods of Testing Cotton Fibres. Table I. "Tensile Strength for Bundles of Various Circumferences and of Different Observed Breaking Loads," commences at an actual circumference of 0.115 in.

There appear to be four waves between 77 and 157 lb., so if they are due to inertia error the pendulum will have jerked at load intervals of approximately 20 lb. This is the order of interval to be expected on this type and capacity of machine.\*

Inertia error is at least a possible explanation of the variation in breaking stress and, as the average variation appears to amount to about 6 per cent. on the weaker bundles, it seems advisable to modify the test procedure, for instance by a reduction in jaw speed, so that inertia errors are less likely to arise.

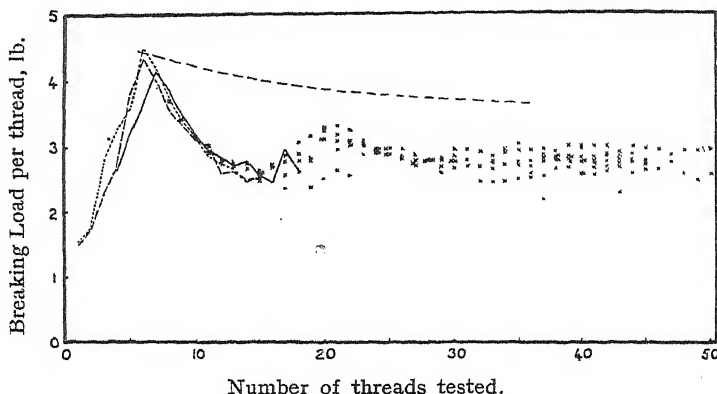


Fig. 2. Variation in strength per thread in tests on strips of cloth of varying width.

#### The Effect on the Apparent Strength per Thread of Small Changes in Width in Short Specimens of Cotton Cloth

A simple method of investigating the inertia error wave is to break a long strip of cloth repeatedly, a short length at a time, removing one or two threads from the remainder of the strip after each test. The results, when expressed as strength per thread, would normally be expected to remain constant, or to show a simple trend, but if a pendulum inertia error is present a wave form is to be expected. Weft way strips with all the threads coming from one cop should give the most regular results, but this direction restricts the length of strip available for testing to the width of the cloth.

In an experiment on these lines weft way strips from a plain woven cotton filter cloth were used. The weft was 32s/3 combed Uppers quality. Tests were made on a Scott machine, 400 lb. capacity,  $\frac{1}{2}$  inch between the jaws, 10.4 inches per minute rate of traverse. A load extension chart was drawn for each break and the retaining pawls were in action. Fifteen tests were obtained from each strip. Several strips were tested varying in initial number of threads from 50 down to 15. Fig. 2 reproduces the values obtained for strength per

\* From the text it appears that the machine capacity is 300 lb., and the jaw speed 12 inches per min. From the photograph the testing machine appears to have been made by H. L. Scott. If we may assume that it complied with the A.S.T.M. specification for pendulum type testers, the pendulum deflection at full load was  $45^\circ$ , and the pitch radius of the chain drum in the pendulum head was 11 inches minimum, from which the machine rate of load,  $\mu^0$ , is 340 lb./inch. Then by measurement of the photograph, using an assumed distance between the lea test hooks of 27 inches to fix the scale, the radius of the centre of oscillation of the pendulum is about 18 inches, from which the natural period of oscillation of the pendulum works out at about 1.4 seconds.

The experiments with weights in paper VIII indicated that the period of the error wave approaches one-quarter of the natural period of the pendulum. In the present experiment the head jaw moves at practically the same speed as the pulling jaw, namely 12 in. per minute. The period of the error wave would be expected to be 0.34 secs., in which time the head jaw would move 0.068 inch and the pointer would move through 23.1 lb.

thread plotted against the number of threads in the strip. The results for the three narrowest strips are joined by lines and show a pronounced crest at 6 and 7 threads, but the results of wider strips are more variable and, although there appears to be a second crest at about 20 threads, the third crest is lost in the variability of the material. This test material was chosen for its regularity, so more difficulty is to be expected with more usual, and irregular, cotton fabrics.

The mean strength per thread for the wider specimens is 2.75 lb. The trough at 15 threads averages 7.2 per cent. below this mean, and the crest at 20 threads appears to be rising to about 18 per cent. above the mean.

The maximum inertia error has been calculated for 6, 22 and 36 threads from Martindale and Woods's formula (paper IV, S<sub>31</sub>)<sup>8</sup> taking 11.3 per cent. for the extension at break of the fabric,  $\mu_0 = 454$  lb./in.,  $T = 1.40$  secs.,  $v = 10.4$  in./min. and assuming  $s = s_0$  for these small deflections of the pendulum. The calculation values are:—

Threads broken	...	...	...	6	22	36
Maximum possible inertia error, per cent.	...	61.8	39.2	32.0		
Maximum expected strength per thread, lb....	4.45	3.83	3.63			

A curve has been drawn through these calculated values on Fig. 2. It agrees with the experimental value for 6 threads, but it is much too high for the wider strips.

The load extension charts for strips wider than 15 threads showed an obvious wave at about 38 lb. and the charts for strips wider than 28 threads showed a second wave at about 80 lb. These loads correspond with the first and second troughs in Fig. 2. Some of the curves for the strongest specimens showed a third wave also, but not sufficiently clearly for its position to be measured.

A similar experiment on a horizontal Goodbrand machine with the jaws set  $6\frac{1}{2}$  in. apart gave indications of two waves, but there was considerable variation in the data, and it was clear that a different experimental method was required which would give results more suitable for statistical analysis.

#### The Effect of Changes in the Number of Loops in the Lea Test for Yarn Strength

As in cloth testing it is a simple matter to vary the specimen width a few threads at a time, so in the lea test, although it is customary to break a lea of yarn wrapped in a skein of 80 loops, it is a simple matter to vary the number of loops and so to discover whether the strength per loop remains reasonably constant or whether machine errors introduce inconsistencies. Accordingly a test was carried out on a Goodbrand lea tester as follows:—

The yarn was a commercial 80s/3 super combed and gassed Giza quality with 18 turns per inch in doubling.

The machine details were:—

Capacity, 130 lb.

$v$  = Speed of pulling hook 12 inches/min.

$\mu_0$  = Machine rate of load, 109 lb./inch.

$T$ , Natural period of pendulum, 1.025 secs.

The machine was motor driven through reduction gearing. Multiple retaining pawls held the pendulum in position after the break. Readings of the pointer position were taken to the nearest half pound after the pendulum was held firmly by the pawls. There were five pawls and twelve ratchet teeth for 10 lb. load, so the smallest load change shown by the mechanism was one-sixth of a pound. The pawls appeared to move smoothly. The machine was calibrated by dead weights in small increments before the test and a correction was applied to the lowest readings.

Twenty-four pirns of the yarn from one skip were thoroughly conditioned and then tested repeatedly. Eight pirns were put in the wrap reel together and skeins were made varying in number of loops from 3 to 48 in steps of three loops. The numbers were distributed at random down the pirn. In testing this series it became clear that the steps were too large, so subsequently the test

was repeated on the same pirns at the same controlled humidity and by the same observer taking skeins of 1 and 2, 4 and 5, 7 and 8 loops, etc., up to 23, again at random, down the pirn so obtaining strengths for all loops, from 1 to 24, in steps of one loop. Fig. 3 shows the mean strength per loop for each number of loops. The diagram shows an obvious wave repeating on three loops. The troughs coincide with the first portion of the test so they may be due to some change in testing conditions between the two testing periods instead of to the presumed inertia error. However, the machine pointer hesitated at about 5, 10 and 15 lb. during the tests, which corresponds to the troughs found, and, besides the variation in means, there is a similar cyclic variation in irregularity which is unlikely to have arisen through any

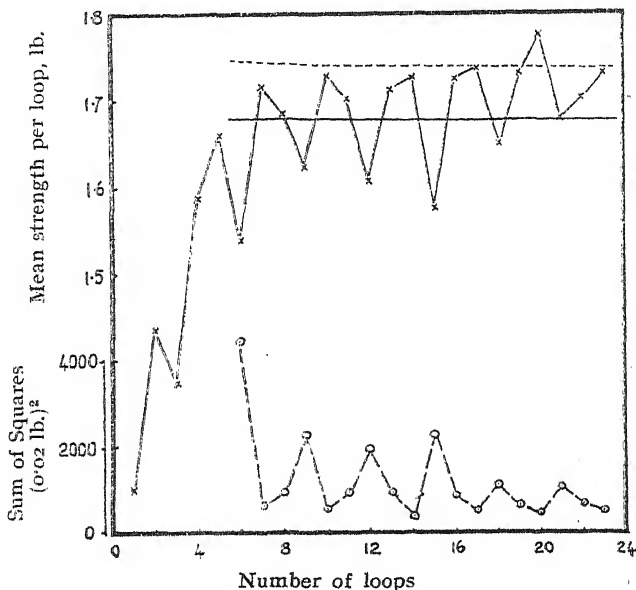


Fig. 3. Variation of strength per loop with the number of loops in the lea test.

unobserved changes in humidity or other testing conditions. It must be concluded, therefore, that the waves are due to some cyclic error in the test, presumably the pendulum inertia error, and not to any change in testing conditions.

The statistical significance of the variation in mean strength per loop was tested for the data of strength per loop from 6 loops to 23 loops, inclusive, 18 loop groups in all for all 24 pirns. The variance was analysed into three sections; between pirns, between loop groups, and residual.

**Analysis of variance, lea test data, units (0.02 lb.)<sup>2</sup>.**

Source	Sum of squares	Degrees of freedom	Mean square
Between loop groups ...	3,997	17	235
Between pirns ...	2,421	23	105
Residual ...	18,823	391	48
Total ...	25,241	431	—

The ratio of the between loop group mean square to the residual is above the 1 per cent. point and the ratio of the between pirn mean square to the residual is between the 1 per cent. and 5 per cent. points, so both sources of variance add significantly to the total and we conclude that the wave is statistically significant.



A further statistical examination was made of the variance within loop groups. The within loop group sum of squares was calculated for each loop group separately and the results are shown plotted on the lower half of Fig. 3. The sum of squares is much higher for six loops than for the others, and there is a cyclic variation repeating on three loops; a high sum of squares coinciding with a low mean strength per loop. The statistical significance of these variations was tested by the  $L_1$  test, using Nayer's tables, by which the ratio of the geometric and the arithmetic means of a series of variances is compared with the ratio for the normal distribution for corresponding degrees of freedom. Various comparisons give the following results:—

	N	k	$L_1$	P
All variances ... ..	24	18	0.820	$P < .01$
All except the variance for 6 loops ... ..	24	17	0.859	$P < .01$
All six crests ... ..	24	6	0.886	$P$ about .01
Five crests excluding the variance for 6 loops ... ..	24	5	0.947	$P > .05$
All troughs ... ..	24	12	0.959	$P > .05$

Evidently, even when the high variance for six loops is omitted, the variation in variance is statistically significant. There is also a real variation between the crest values, though its statistical significance is due to the high value for six loops.

It may be argued that as the number of loops is increased the breaking load variance should fall, although, because the loops are formed from a continuous length of yarn and are not gripped at the hooks, a simple proportional relationship is not to be expected. There is a trend towards lower variances with higher numbers of loops, both with the figures for crests and for troughs, but the change is small compared with the cyclic variation and is not statistically significant so, though the reality of the trend might be proved by more extensive tests, there is no justification for weighting the present data in the analysis of variance.

It is doubtful if either crest or trough values of the variance may be taken as true measures of the yarn variability as the inertia error is likely to cause abnormally regular breaks at one point, and abnormally irregular breaks at another. There is, therefore, this further objection to high speeds of traverse on pendulum type machines, that the standard deviation of the results is biased.

The experimental wave has been compared with the theoretical maximum possible inertia error as for the previous example, taking the effective extension at break of the yarn, from separate measurements, as 3.0 per cent.\* and the mean strength per loop as 1.68 lb.

Loops broken ... ..	6	13	20
Calculated mean breaking load, lb. ... ..	10.1	21.8	30.6
Maximum possible inertia error, per cent. ... ..	3.9	3.6	3.5
Maximum expected strength, per loop lb. ... ..	1.745	1.741	1.738

The curve of the theoretical maximum strength per loop is shown in Fig. 3, and comes rather above the mean values, but the experimental wave extends well below the mean also, so that in the neighbourhood of 20 loops, for instance, the range of strength is about  $5\frac{1}{2}$  per cent. and, for smaller numbers, the range approaches twice the calculated value. This may be because the formula of Martindale and Woods gives the overthrow only, and not the low values due to accelerating the pendulum.

This experiment investigates the lea test at the low end of the dial only, and inertia error waves are demonstrated only for specimens of a quarter of a lea and less. Further, the material is unusually regular and inextensible. It

\*NOTE.—The effective extension is the extension measured on the latter part of the load extension curve. The load extension chart for this yarn showed the usual rapid initial extension followed by a straight line relationship between load and extension up to the break. The slope of the straight portion was equivalent to 3.0 per cent. extension from zero to breaking load. It has been assumed in the present calculations that the effect of the early, rapid extension is negligible.

is quite likely, therefore, that smaller inertia errors are to be expected in normal testing practice, but, on the other hand, the error waves are shown to persist through at least seven cycles, so there are evidently some circumstances in which the effect is not damped by the test specimen and in which the whole extent of the calculated error may be found in practice.

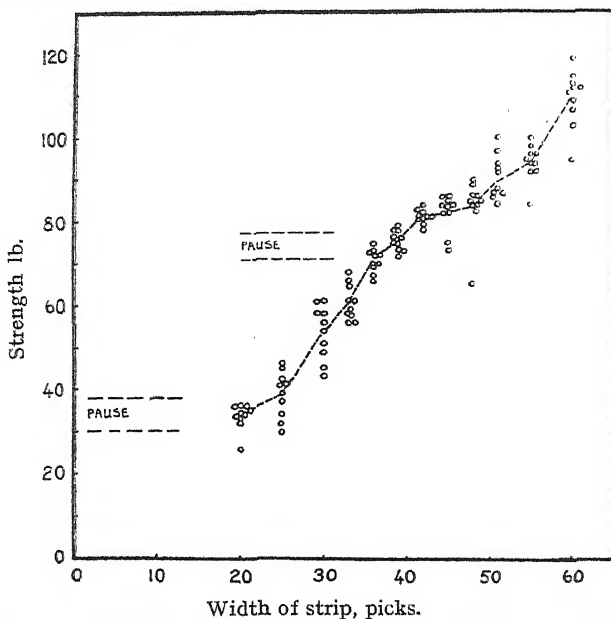


Fig. 4. Strength of weft way strips of Florentine drill with the width and length varied simultaneously.

#### The Effect of Simultaneous Variation in Specimen Width and Length of Cloth Strips

As explained in the introduction, the testing conditions round about the break of a particular size and type of specimen can be traversed by simultaneous adjustment of both specimen width and length. This has been done with weft way strips of a Florentine drill tested on a horizontal Goodbrand machine.

The weft was 22s/2 American cotton 55 picks per inch.

The machine details were:—

Capacity 700 lb.

$v$  speed of pulling jaw 18 inches/min.

$\mu_0$  machine rate of load 638 lb./inch.

$T$ , natural period of pendulum 1.25 secs.

The machine was motor driven through reduction gearing. Multiple retaining pawls held the pendulum in position after the break. The machine pointer pushed before it a light wire pointer pivoted loosely on the main pointer pivot. The position of the wire pointer after the break was read. The machine pointer usually fell back a pound or two after the break as the pawls engaged in the ratchet quadrant. The wire was not seen to jerk forward when the specimens broke.

The cloth was first cut into cop widths and then test specimens were prepared from five of them. From each cop width strips were cut twice the length of the specimens and frayed down to the number of threads required. This provided two tests from every strip and a complete series of tests from each cop. Preliminary tests had shown where the pointer hesitated so the specimens were arranged to give more results at this place. Load-extension diagrams had also shown the customary rapid initial extension, followed by a straight line relationship. From a typical curve, from which  $E=0.00625$

inches/lb., specimen lengths were calculated which would give extensions approximately proportional to the breaking load for each strip width. The strip dimensions tested were:—

Number of picks ... 20 25 30 33 36 39 42 45 48 51 55 60

Distance between  
jaws, inches ... 3.7 4.3 4.9 5.2 5.6 5.9 6.3 6.6 7.0 7.3 7.8 8.4

Fig. 4 shows the individual results of the test with the breaking loads plotted against the specimen width and length. The results obviously follow a wavy line similar to that found on load-extension curves and demonstrate that it is possible to traverse such a line with actual breaking load results.

The movement of the pointer was watched closely during the tests. It was an easy matter to note, approximately, the part of the scale at which the pointer slowed down. The apparent pauses occurred at 30 to 38 lb. and at 71 to 77 lb. The latter does not quite agree with the experimental curve so it seems that the specimen length adjustment had not been quite accurate, but this does not spoil the validity of the experiment.

The data, reduced to strength per thread, have been analysed statistically by the analysis of variance and the  $L_1$  test, which prove that the wave is statistically significant and that the data are significantly more regular for the high strength per thread means (36, 39 and 42 pick strips) than for the low strength per thread means.

#### Analysis of Variance. Florentine weft data, units (1 lb.)<sup>2</sup>.

Source	Sum of squares	Degrees of freedom	Mean square
Between strip widths ...	1.551	11	0.1410
Between repeats ...	.552	9	0.0613
Residual ...	1.253	99	0.0127
Total ...	3.355	119	—

$L_1 = 0.675$ .

(from Nayer's table for  $k=12$  and  $N=10$ ,  $L_1=0.789$  lies on the 1% level of significance).

Much the larger part of the variation in variance appears to be associated with the variation in means, but there is a trend also, in which the variance falls as the strip width increases, as would be expected from statistical theory.

Martindale and Woods's formula has been used, as before in this paper, to estimate the maximum possible inertia error. Taking the grand mean strength per pick, of 1.796 lb., an effective extension of 8.3 per cent. and a strip 36 picks wide, 5.6 in. between the jaws, the maximum strength per pick works out at 2.014 lb. This is slightly more than the experimental result, but the succeeding minimum strength, at 55 picks, is 4.8 per cent. below the mean, and the range from crest to trough in the mean values is greater than the calculated inertia error.

A second test was made on specimens from the same piece of cloth, but using wider strips and a different load-extension gradient ( $E=0.00408$  inches/lb.) which, it was thought, would make the results fit the observed pauses more closely. One set of samples was prepared from each of ten cops. The strip dimensions tested were:—

Number of picks ... 51 55 60 63 66 69 72 75 78 81 85 90

Distance between  
jaws, inches ... 4.8 5.1 5.4 5.6 5.8 6.0 6.2 6.4 6.6 6.8 7.1 7.4

The mean strengths per thread in the first experiment appeared to follow a saw-tooth wave like that obtained in the earlier experiment with weights,

and the means for the narrower strips in the second experiment similar, followed a straight line down to a minimum, but the means for the three widest strips did not show the expected rise. The analysis of variance showed that the significance of the between strip widths variance was just below the 5 per cent level, and the value of  $L_1$  was not significantly different from unity. Omission of the three widest strips from the analysis brought the ratio of  $t_1$  between strip width variance up to the 1 per cent. level, but the results remain much less spectacular than the first experiment and the value of  $L_1$  was still not significantly different from unity. It seems likely that the chief reason for this different result is an unsuitable choice of specimen lengths. This view is supported by the results of further tests in which specimens of the same width as those which gave the highest and lowest results in the second experiment were tested at other specimen lengths. Specimens 51 picks wide and 4.8 inches between the jaws, gave the maximum strength in the second experiment, but in further tests, at jaw spacings of 2.9, 3.6, 4.2 and 4.4 inches, maximum strength was reached at about 3.6 inches. Similarly 69 pick strips 6.0 inches between the jaws gave the minimum strength in the second experiment, but with this strip width further tests at jaw spacings of 5.1, 5.7, 6.3 and 6 inches, indicated that the lowest strength was to be expected at the original spacing of 6.0 inches between the jaws. It seems likely, therefore, that a steeper gradient, more nearly equal to that used in the first experiment would have given a more obvious wave.

**Analysis of Variance. Florentine weft, 2nd experiment, strength per thread units (1 lb.)<sup>2</sup>**

Source	Sum of squares	Degrees of freedom	Mean square
Between strip width ...	0.1635	11	0.01305
Between cops ...	0.3015	9	0.03339
Residual ...	0.6687	99	0.00675
Total ...	1.1337	119	—

**Analysis of Variance. Florentine weft 2nd experiment, excluding widest strip**

Source	Sum of squares	Degrees of freedom	Mean square
Between strip width ...	0.1300	8	0.01625
Between cops ...	0.1777	9	0.01974
Residual ...	0.3991	72	0.00554
Total ...	0.7068	89	—

It would be expected from general considerations that a maximum inertia error could be obtained at a particular point only by a nice adjustment of the variables, and so this method of simultaneous variation of width and length can be effective only when the extension characteristics of the test material are well known.

**The Effect on the Apparent Strength of Cloth Strips of Varying the Starting Position of the Pendulum**

In the earlier experiments with weights it was shown that the inertia error wave could be traversed by advancing the starting position of the pendulum. The experiment now to be described applies the same idea to tests with fabric strips. The advantage of this method of investigation is that the strip dimensions are constant throughout the test, which eliminates one source of variation in the group variances, so showing up more clearly the effect of inertia error on variance.

A comparison of parallel routine tests from two laboratories had shown considerable discrepancies both in means and in standard deviations and, as calculations showed that considerable inertia errors were to be expected in both sets of results, a special investigation was undertaken on one machine. The particulars were:—

Testing machine: Scott 400 lb. capacity, 10.4 inches/minute rate of traverse, machine rate of load,  $\mu_0$ , 454 lb./min., natural period of the pendulum, T, 1.40 secs.

Fabric: Weft strips 1 in. wide, 4 in. between the jaws. Three shaft drill. Five cop widths of cloth were taken from the same cutting and from each cop width five strips were cut the full width of the cloth and frayed down to 50 picks wide. Then, after thorough conditioning, each strip was tested eight times along its length, each time with the pendulum starting from a different place. The starting point for successive tests was chosen at random for each test. The results were analysed statistically for each cop width separately and then, as the between-strip variance was significantly greater than the residual for each cop the results were regrouped into five classes in which the strip means were more nearly equal. The data in these classes were analysed again separately for each class as before.

Analysis of Variance. Drill weft, units ( $\frac{1}{2}$  lb.)<sup>2</sup>

	Degrees of freedom	Mean square					All cops
		Cop E	F	G	H	I	
between pendulum settings ...	7	38.05	21.48	33.07	20.80	15.71	25.82
between strips ...	4	43.15	210.05	274.16	180.00	200.24	181.52
residual ...	28	14.93	19.29	11.92	8.44	12.81	13.48
<hr/>							
		Class V	W	X	Y	Z	All classes
between pendulum settings ...	7	19.17	52.06	12.61	24.68	31.68	28.04
between strips ...	4	42.46	27.48	7.44	16.56	10.03	20.79
residual ...	28	5.32	22.86	6.98	11.25	11.08	11.50

Significance from ratio tables by Mahalanobis

\* barely on the 5 per cent. point of significance

\*\* between the 5 per cent. and 1 per cent. points

\*\*\* on the 1 per cent. point and over.

The analysis shows that the rearrangement of the strips improves the comparison, eliminating much of the between strip variation and improving the significance of the between-pendulum-settings variance, but even without rearrangement the between-pendulum-settings variance is significantly different from the residual.

The variance was tested for homogeneity by the  $L_1$  test for which the variance for each pendulum setting in each class of five strips was calculated separately and then these were combined for all five classes, yielding eight variances based on twenty-five tests each. The value of  $L_1$  was 0.8487 which, for  $k=8$  and  $N=25$  lies between the 0.05 and 0.01 levels of significance.

Figure 5 shows the mean values of strength for each pendulum setting in each class, together with the sum of squares for all classes. Classes V, W and X and the variance show an obvious wave, but Y and Z do not. The graph of the mean of all classes is similarly wavy. It is not clear why classes Y and Z have failed to show a wave. The mean curve ranges from a maximum of

71.82 lb. at 6 lb. starting point to 69.46 lb. at 12 lb. starting point; a range of 3.3 per cent. whereas the calculated value of the maximum possible inertia error for the conditions of this test is 15.3 per cent. The range for the largest wave, Class W, is 7.2 per cent., or about half of the calculated value, but the graph of the variances shows that the results are very variable when the mean strength curve reaches both its minimum and its maximum, so it would be unwise to suppose that the error in individual results is never larger than the mean variation found in this experiment, or in Class W. It seems more likely that the full calculated error has occurred in many of the tests, but that the variability of the material has made the waves overlap, so lowering the crest, and raising the trough, and increasing the variability.

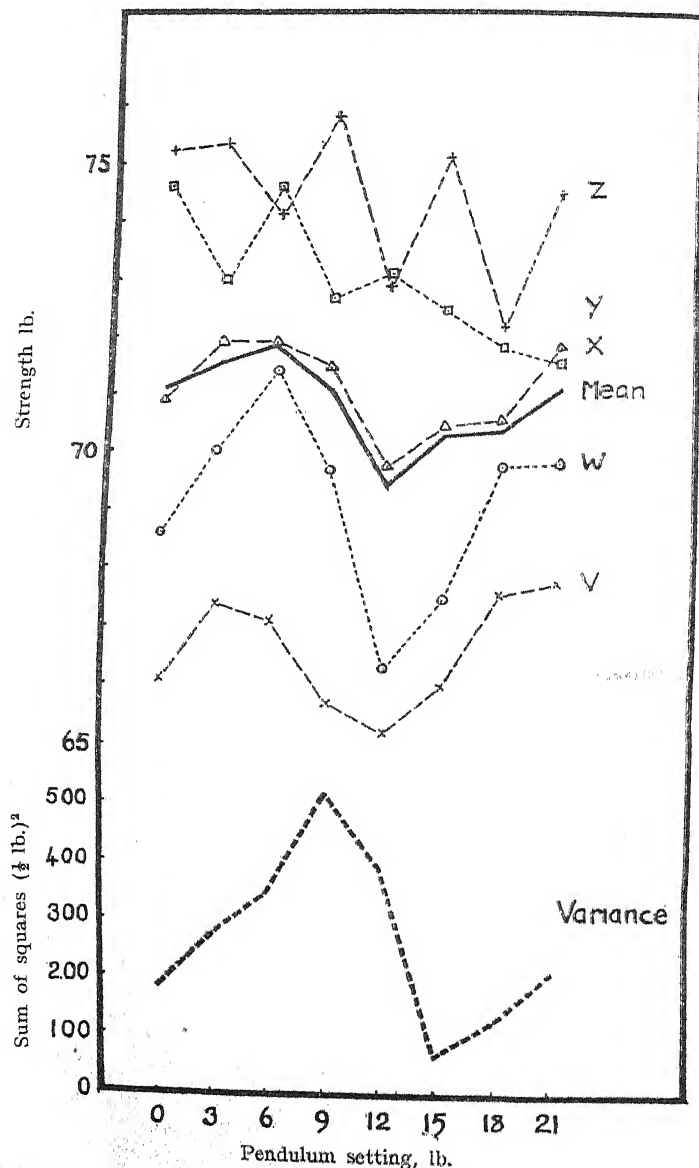


Fig. 5. Variation in the apparent strength of weft way strips of 3 shaft drill as the starting position of the pendulum is altered.

## GENERAL DISCUSSION

Two examples from the literature and four special experiments have been employed to demonstrate the practical importance of the inertia error in pendulum type-testing machines. Routine load-extension charts on a wide variety of fabrics show that waves invariably occur at normal jaw speeds. In general, the first wave along a trace is shorter than the remainder, and the more extensible the test piece the shorter the waves tend to be. Repeats of the wave can commonly be followed through five cycles, and even up to seven, but there are some indications that waves of the correct period, but which fail to die away, may be caused by friction in the head jaw. Such waves can be demonstrated by deflecting the test specimen round guide pulleys arranged between the machine jaws. Then, as the specimen extends under load, the pulleys slowly rotate, but the friction in their journals may be sufficient to make their action jerky, and so to keep the pendulum moving jerkily throughout its traverse. A similar friction effect may be present in the head jaw slides of horizontal machines when they are inadequately lubricated, and, again, quite small burrs on the teeth of the ratchet quadrant are capable of modifying the pendulum movement and regenerating the inertia wave.

Matthew's data appear to cover the second and beginning of the third wave; Richardson, Bailey and Conrad's data appear to trace from the fifth to the tenth wave. In the present tests waves extending to seven repeats were found in the lea test and up to five in a test on cloth. Presumably, the more nearly perfect the elasticity of the material, the more clearly will the waves persist, but when many waves are present small differences in strength or in extensibility between samples will mask the effect of the waves on the average breaking load.

The significant variations in variance, found in addition to the variations in average strength, show that even in these special experiments the variations in average strength do not measure the whole of the calculated inertia error. It does not seem possible to find out how much of the breaking load indicated for a particular strip is inertia error. Real variations in strength merge with variations in the error to produce a general variability which cannot normally be split up. However, the variations in average and variance appear to be broadly in accordance with the theoretical calculations. The crests of the later waves do not always rise to the expected level, but on the other hand the data show negative inertia errors occurring immediately after a pause when the pendulum is being accelerated, and the calculations do not provide for this, so that, in the absence of more precise information, the formula proposed by Martindale and Woods (paper IV S31) can be used to estimate the probable maximum inertia error occurring in individual test results.

The current A.S.T.M. standard for textile testing machines<sup>7</sup> requires that the specimen shall break when the angle which the pendulum makes with the vertical is between 9 and 45°. In practice the pendulum is deflected to 45° at the maximum reading of the machine and the lower limit for specimen breaks is marked at one-fifth of this. Similarly the U.S. Government<sup>8</sup> has fixed a limit at one-tenth of the machine capacity. It seems likely that these limits have been fixed from practical experience of the unreliability of results obtained at small pendulum deflections. Martindale and Woods' formula could be used to estimate more precisely the lower limits of the dial reading which should be employed for particular specimen characteristics. The higher the jaw speed used, the higher the limit of readings should be. It seems impracticable to have speed changes from cloth to cloth on this type of testing machine. Some Goodbrand machines are already provided with gear boxes giving a speed of  $4\frac{1}{2}$  inches per minute. Much lower speeds than this appear to be indicated by the formula for linen and cotton if the inertia error is to be kept down to  $\frac{1}{2}$  per cent., but these make the test very slow. Bearing in mind the other possibilities of error and the probable effect of averaging, it may be advisable to standardise Goodbrand machines at  $4\frac{1}{2}$  inches per minute rate of

traverse and to prescribe minimum breaking loads for particular types of fibre or particular cloth extensibilities. These minima could be calculated, but it might be sufficient to take them as a multiple of the observed wave length, e.g. ten times the load at the first pause. It would be necessary to increase the width of specimen for weak fabrics to bring their breaking loads up to the calculated minimum. This is already done to some extent; fabrics being tested in widths of 2 in., 4 in. and  $6\frac{1}{2}$  in. Comparisons between different fabrics would be complicated by the variations in strip width, but complications from one source or another seem to be inevitable.

The present tests do not provide an exhaustive examination of the behaviour even of cotton fabrics. They have had to be confined, indeed, to somewhat unusual testing conditions in order to obtain measurable errors and the results must be used with caution. It may be that inertia errors do not account for any large part of the differences experienced between laboratories in tests of warp way strips of heavy drills and ducks, but it is usual to test weft way strips under the same conditions and these, being commonly weaker and less extensible, are more likely to give appreciable inertia errors. The wide variety of fabrics makes it likely that tests are frequently attempted on unsuitable capacities of machines and the use by some British firms of American specifications, built on the vertical Scott machine, introduces strip dimensions smaller than are advisable for the usual Goodbrand machine. Further, as the industrial uses of fabric extend, tests are likely to be made on pendulum type machines designed for other materials. When the testing facilities are not ideal there is a temptation to argue, for instance, that the lower portion of the scale of a heavy capacity machine is sufficiently accurate for routine testing because there appears to be no reason why a small deflection in a pendulum balance device should not be measured accurately. But the difficulty is not with the pendulum regarded as a static weighing device. Luckily the presence of serious errors can be judged easily from the motion of the pointer.

It is to be expected that a particular cloth will give fairly consistent results in repeat tests on one machine, but it does not follow that equivalent results should be expected on a different machine, or that consistent differences will be found between cloths. A specified strength will normally be fixed from experience with a particular set of conditions, but these conditions may give rise to an appreciable overthrow error and the specified figure will then include this error. In the meetings of the Physical Testing Committee of the Institute Standardisation Scheme it has been pointed out that although the strength of a fabric is commonly specified as so many pounds, the figure is to be understood to apply solely to the machine and speed specified, and therefore to include all the errors associated with that machine and speed. It by no means follows that the same strength is to be expected at a different speed, at a different machine capacity, or machine rate of loading, or on a machine differing in the method of applying the load, for example, with a spring loaded machine.

The relative importance of different sources must vary with the conditions. No doubt in some machines the chief errors are due to inadequate maintenance and in others to poor technique. The inertia error is one of many difficulties in fabric testing.

### CONCLUSIONS

(1) Experiments on cotton specimens confirm the reality of cyclic errors corresponding to the inertia errors examined in earlier papers. These affect the mean strength and the standard deviation.

(2) The error cycles or waves persist through several repeats, but the variability of the material makes them difficult to isolate.

(3) The errors are large for relatively weak and inextensible specimens. The jaw speeds in common use on pendulum type machines are too fast. Theory indicates that if the maximum possible inertia error is to be reduced to  $\frac{1}{2}$  per cent., the jaw speed should be reduced for linen and cotton to less



than one twentieth of its present value. This would make testing impracticably slow. As interest is centred chiefly on the average of a set of tests and the inertia error probably varies within such a set, it may be permissible to provide for a higher maximum possible inertia error, of say 2 per cent., and to employ schedules of minimum breaking loads for different types and dimensions of specimen. It is suggested that the speed of  $4\frac{1}{2}$  inches per minute now used on Goodbrand machines in some quarters should be regarded as a maximum for cotton and linen fabrics.

(4) It does not appear to be practicable to apply a correction for the inertia error except, perhaps, to the results of the Chandler bundle test in which the extensibility of the specimen is likely to be so small that the error is independent of the test specimen.

Much of the work reported in this paper has been done by Mr. W. Clegg and Miss B. Wadsworth. The author's thanks are due to them, and also to the Directors of Messrs. Ashton Brothers & Company, Limited, for permission to publish the paper.

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## **TENTATIVE TEXTILE STANDARD No. 7, 1942**

### **Specification for a Bundesmann Type Water Repellency Testing Machine**

Tentative Textile Standard No. 7, 1942—"Specification for a Bundesmann Type Water Repellency Testing Machine," published in the *Journal* of the Textile Institute, 1942, 33, S50-S52, has been before the members of the Institute for the required period of ten months. It is proposed, unless any objections are received, to submit this tentative standard to the British Standards Institution for acceptance as a British Standard (Textile). Comments should reach the Acting General Secretary not later than 31st December.

The Method of Test for a Bundesmann Type Water Repellency Testing Machine will form the subject of Tentative Textile Standard No. 8. This will be published at a later date.

## **TENTATIVE TEXTILE STANDARD No. 1a, 1942**

### **Standard Method for Determining Resistance to Shrinkage of Wool Fabrics**

This tentative standard was published in the *Journal* of the Textile Institute, 1942, 33, S41-S48. In the light of further development work the recommendations are now being revised. The technical committee which is dealing with this work will also give consideration to any comments on the published tentative standard which are received not later than 31st December.

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